CSM Unit 1, Upper Watersheds

Moon Creek

CONTENTS

CONTENTS (Continued)

ATTACHMENTS

FIGURES

TABLES

ABBREVIATIONS AND ACRONYMS

AWQC	ambient water quality criteria
BLM	Bureau of Land Management
CDA	Coeur d'Alene
CDR	Coeur d'Alene River
cfs	cubic foot per second
COPC	chemical of potential concern
CSM	conceptual site model
CV	coefficient of variation
East Fork	East Fork of Moon Creek
EPA	U.S. Environmental Protection Agency
EV	expected value
FIS	flood insurance study
FS	feasibility study
IDEQ	Idaho Department of Environmental Quality
MFG	McCulley, Frick & Gilman, Inc.
µg/L	microgram per liter
MoonCrkSeg	Moon Creek segment
msl	mean sea level
PDF	probability density function
PRG	preliminary remediation goal
redox	oxidation reduction
RI	remedial investigation
SL	screening level
South Fork	South Fork Coeur d'Alene River
TMDL	total maximum daily load
URSG	URS Greiner, Inc.
USGS	U.S. Geological Survey
West Fork	West Fork of Moon Creek
WRCC	Western Regional Climate Center

1.0 INTRODUCTION

The Moon Creek Watershed is located within the Coeur d'Alene River basin and is a south to southwest-flowing tributary of the South Fork Coeur d'Alene River (South Fork). The Bureau of Land Management (BLM) has identified 14 source areas (e.g., mining waste rock dumps, adits, and jig tailings piles) within the watershed (BLM 1999). Though the West Fork of Moon Creek is relatively unaffected by mining activities, the main stem of Moon Creek has been heavily affected.

During the 1998, 1999 and 2000 field seasons, the USDA Forest Service implemented the East Fork Moon Creek Reclamation Project as a CERCLA non-time critical removal project to address the Charles Dickens and Silver Crescent mine and mill sites. The project entailed removing 130,000 cubic yards of jig and flotation tailings, waste rock, and contaminated soil with placement in an unlined combined waste repository onsite. The repository base includes a limestone drain system with impervious berm to address groundwater. The cover is an engineered multi-layer capillary-break type cap containing a geosynthetic clay liner. This project also included closing and sealing four adits and two mine shafts. While the drainage from the Silver Crescent adit had sample results that indicated neutral pH and low metals, a wetlands buffer was installed to intercept this drainage. In addition, the project included over 3300 feet of channel rehabilitation, floodplain re-construction and nearly 10 acres of revegetation by seeding and planting methods (REI 2000 and Johnson 2000).

This watershed is one of eight watersheds assigned to conceptual site model (CSM) Unit 1, Upper Watersheds (see Part 1, Section 2, Conceptual Site Model Summary). The watershed itself has been divided into two segments to focus this investigation (Figure 1.1-1). Brief descriptions of each segment are presented in this section.

1.1 SEGMENT DESCRIPTIONS

Segment MoonCrkSeg01 contains the headwaters of the West Fork of Moon Creek (West Fork) down to its confluence with Moon Creek (Figure 4.1-1). The BLM identified two source areas in this segment. This segment has been relatively unaffected by mining activities.

Segment MoonCrkSeg02 contains the headwaters of Moon Creek and continues down the main stem of Moon Creek to its confluence with the South Fork (Figure 4.1-2). The BLM identified 12 source areas in this segment. Mining and release of tailings from the Silver Crescent Mine and Mill and the Charles Dickens Mine have caused the deposition of mining waste on the narrow floodplain of the lower part of Moon Creek. Remediation work has been implemented at the above sites. Sampling of surface water indicates that metals concentrations in surface water are greater than ambient water quality criteria (AWQC).

1.2 REPORT ORGANIZATION

The remedial investigation report is divided into seven parts. This report on the Moon Creek Watershed is one of eight reports contained within Part 2 presenting the RI results for the eight CSM Unit 1 upper watersheds. The content and organization of this report are based on the U.S. Environmental Protection Agency's (EPA's) Guidance Document for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final (USEPA 1988). This report contains the following sections:

- Section 2–Physical Setting, includes discussions on the watershed's geology, hydrogeology, and surface water hydrology.
- Section 3–Sediment Transport Processes
- Section 4–Nature and Extent of Contamination, includes a summary of chemical results and estimates of mass loading from source areas
- Section 5–Fate and Transport, includes chemical and physical transport processes for metals
- Section 6–References

Risk evaluations and potential remedial actions associated with source and depositional areas are described in the human health risk assessment, the ecological risk assessment, and the feasibility study (all under separate cover).

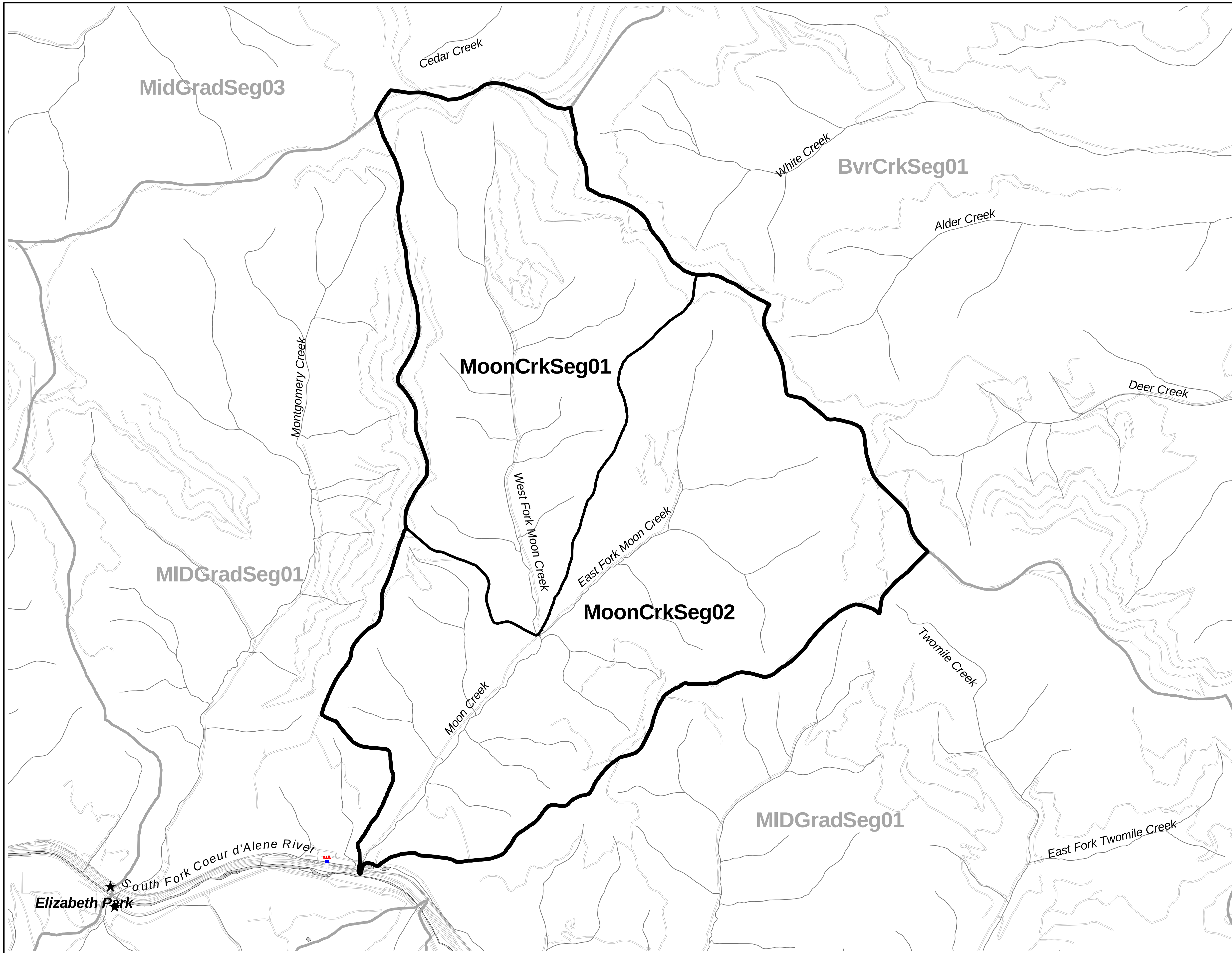
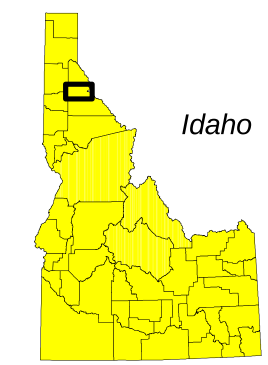


Figure 1.1-1
Moon Creek Watershed

LEGEND

- Stream
- Road
- Interstate 90
- City
- Moon Creek Segment Watershed
- Moon Creek Segment
- River Segment
- Lake/River



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

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027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

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L: Final RI Moon Creek
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This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 11, 2001

2.0 PHYSICAL SETTING

2.1 GEOLOGY AND MINES

The geology and mining history of the Moon Creek Watershed are presented in this section.

2.1.1 Geomorphic Setting

The Moon Creek Watershed is located on the north side of the South Fork Coeur d'Alene River (South Fork), about 3 miles east of Kellogg and 7 miles west of Wallace (Part 1, Figures 1.2-1 and 1.2-2). Moon Creek, West Fork Moon Creek, and East Fork Moon Creek are the principal drainages of the watershed. The elevation change in the watershed is approximately 2,000 feet, with elevations ranging from about 4,500 feet above mean sea level (msl) at the headwaters of West Fork Moon Creek and East Fork Moon Creek, to 2,500 feet msl at the confluence of Moon Creek and the South Fork. Like most drainages in the district, East Fork, West Fork, and Moon Creek all flow through narrow, steep-walled, V-shaped canyons throughout their course.

2.1.2 Bedrock Geology

Weakly metamorphosed sedimentary rocks assigned to the Precambrian Belt Supergroup are the most prevalent rocks within the Moon Creek Watershed. Most of the watershed lies within Prichard Formation argillite with the exception of the headwaters of West Fork Moon Creek and East Fork Moon Creek, which drain the Burke Formation quartzite (Umpleby and Jones 1923).

Waste rock piles are present at all mine workings and consist of broken, angular rock that is generally not milled and is typically dumped near the mouth of workings. The chemical content of waste rock in the Moon Creek Watershed is discussed in Section 4, Nature and Extent of Contamination.

2.1.3 Structural Geology

Northwest-trending faults dominate the structural fabric of the Moon Creek Watershed (Hobbs et al. 1965). The trace of the Moon Creek Fault crosses the confluence of Moon Creek and the South Fork (Part 1, Figure 3.2-1), and other unnamed, northwest-trending faults are present within the watershed but not shown on figures in this document (Hobbs et al. 1965).

Parallel to the trend of the northwest-trending faults is a prominent anticlinal fold, designated the Moon Creek Anticline (Hobbs et al. 1965). The fold axis of the Moon Creek Anticline (not shown on any figure in this document) is about 1 mile southwest of the Moon Creek Fault (Hobbs et al. 1965).

2.1.4 Soils

Like most of the soils throughout the district, the soils of the Moon Creek Watershed can be grouped into two broad categories: hillside soils and valley soils. Hillside soils typically consist of silty loam with variable amounts of gravels and clay, generally less than 2-feet thick (MFG 1992; Camp Dresser & McKee 1986). Valley soils are primarily found within and along the flanks of the lower reaches of Moon Creek, and along the 0.5-mile reach of West Fork Moon Creek above its confluence with Moon Creek (Part 1, Figure 3.2-1). The valley soils are mapped as Quaternary alluvium.

In the Moon Creek Watershed, Quaternary alluvial deposits are a mixture of cobbly gravels, sands, and silts. West of the 2-mile-long reach of Moon Creek above the confluence with the South Fork are relatively small deposits of Quaternary terrace gravels, which are characterized by well-developed sandy soil overlying cobbly to bouldery gravels (Part 1, Figure 3.2-1, map symbol QTog) (Box et al. 1999).

2.1.5 Ore Deposits

Eight mines reportedly operated in the Moon Creek Watershed; however, the only recorded production was from the Charles Dickens Mine and the Silver Crescent Mine on East Fork Moon Creek (Stratus 1999).

The deposits at the Charles Dickens and Silver Crescent Mines consist of what is referred to as fault-controlled fissure vein deposits, which are steeply dipping veins hosted primarily by the Prichard Formation (USFS 1995). The principal ore minerals are galena (lead and silver) and sphalerite (zinc) (USFS 1995). The main non-ore (gangue) minerals are quartz, pyrite, and pyrrhotite (USFS 1995). Aside from pyrite associated with the ore deposits, the Prichard Formation commonly contains disseminated pyrite as irregular grains and crystals aligned parallel to the bedding (USFS 1995).

2.1.6 Mining History

A brief summary of available information on historical mining activities is presented in this section. During the RI/FS process, an extensive list of mines, mills, and other source areas was developed based on a list originally developed by the Bureau of Land Management (BLM 1999). This list is presented in Section 4.1, Nature and Extent, and in Appendix I.

Mining in the Moon Creek watershed began around 1902, when the Charles Dickens Mine first reported documented ore production. Records indicate at least eight mines and two prospects having been located in the watershed (Ridolfi 1998). Production records for the Evolution Mining District, in which the Moon Creek Watershed is located, indicate that most of the recorded ore production for the Moon Creek Watershed can be attributed to the Charles Dickens Mine. The Charles Dickens, which later consolidated with the Silver Crescent Mine, produced a recorded 4,604 tons of ore between 1902 and 1930. From this ore, an estimated 367 tons of lead, 39 tons of zinc, 16 tons of copper, 0.5 tons of silver and 31 ounces of gold were recovered (Mitchell and Bennett 1983). It has also been estimated that approximately 3,803 tons of tailings were produced during the processing of the Charles Dickens' ores at the Charles Dickens/Silver Crescent Mill (SAIC 1993). None of the other mines located in the watershed have documented production histories.

Some of the other mines that operated in the Moon Creek Watershed include the Cogdill Mine, Highland Mine, Main Standard Mine, Royal Anne Mine, and Washington-Idaho Mine. An unnamed tunnel and several unnamed adits have also been identified within the watershed (CH2M HILL 1998). Additional details of the mining and milling history of the Charles Dickens and Silver Crescent mines are included in the following sections.

2.1.6.1 Mines

The mines that operated in the Moon Creek Watershed for which ore production was recorded are listed in Table 2.1-1. This table includes the production years of the mine, estimated volumes of ore and tailings produced as a result of the mining activity and the segment in which the mine is (or was) located. Only mines with documented ore production are listed. Additionally, some mining operations were carried out at more than one location, occasionally in more than one segment or even more than one watershed. The ore production listed in Table 2.1-1 is the total production for all of the mining operations.

2.1.6.2 Mills

Table 2.1-2 lists the mills with operations in the Moon Creek drainage for which there are records. This table includes the operating years of the mill and a summary of ownership as well as the segment in which the mill is located. Not all mills are listed, as records were not available for all mills.

2.1.7 Mining Workings

Underground workings in many mines are very extensive and act as collection and distribution systems for groundwater. Individual mine workings in this watershed are typically located within a single, relatively steep ridge. Recharging water infiltrates at the highest levels of a mountain ridge and discharges on the same ridge. This is referred to as a local flow system, characterized by short groundwater flow paths (a flow path is the route by which the water enters and exits the groundwater system) (Toth 1963).

Adits and tunnels in this watershed act as discharge points for groundwater. Typically adit drainage discharges directly to surface water or first infiltrates waste rock piles before discharging to surface water from seeps. Six adits and three shafts (not shown in figures) have been identified in the Moon Creek Watershed (IGS 1997). Three adits within the watershed are known to discharge mine drainage (USFS 1995). The discharge of metals from mine workings is discussed further in Section 4, Nature and Extent of Contamination, and in Section 5, Fate and Transport.

2.2 HYDROGEOLOGY

2.2.1 Conceptual Hydrogeologic Model

The Moon Creek Watershed occupies approximately 10 square miles, and West Fork Moon Creek, East Fork Moon Creek, and Moon Creek are the principal drainages of the watershed (Figure 1.1-1). West Fork Moon Creek flows approximately 3 miles to the confluence with Moon Creek to the south. East Fork Moon Creek flows approximately 2 miles to the confluence with Moon Creek to the south. From the confluence, Moon Creek flows in a southerly direction to its confluence with the South Fork. The elevation change in the watershed is approximately 2,000 feet, with elevations ranging from 4,500 feet above msl at the headwaters of West Fork Moon Creek and East Fork Moon Creek, to 2,500 feet above msl at the confluence with the South Fork.

The hydrogeology of the Moon Creek Watershed can be divided into two main groundwater systems: the bedrock aquifer and the shallow alluvial aquifer. The conceptual hydrogeologic model for the watershed assumes that a single unconfined aquifer is present in the shallow alluvial sediments, and these sediments are the principal hydrostratigraphic unit in the watershed. The shallow alluvial sediments consist of natural materials as well as mine tailings and waste rock.

Although relatively little hydrogeologic data is available for the watershed as a whole, a study of the Silver Crescent Mine and Mill complex located on East Fork Moon Creek confirmed the presence of an unconfined alluvial aquifer that is about 30 feet thick in the vicinity of the mine (USFS 1995). In general, the alluvium increases in thickness from the headwaters of East Fork and West Fork Moon Creek toward the confluence with the South Fork.

The bedrock aquifer within the Moon Creek Watershed consists of argillites and quartzites of the Precambrian formations of the Belt Supergroup, including (principally) the Prichard Formation, and a relatively minor amount of Burke Formation (as reported in Umpleby and Jones 1923) at the headwaters of East Fork Moon Creek and West Fork Moon Creek (Part 1, Figure 3.2-1).

In general, the bedrock has very low permeability. Secondary features such as fractures, faults, or mine workings may increase the permeability substantially. The hydrogeology of the bedrock aquifer is discussed in Section 2.1.7, Mine Workings.

The groundwater system of unconsolidated sediments overlying less permeable rocks occurs in an elongate, V-shaped trough along the entire length of East Fork Moon Creek, West Fork Moon Creek, and Moon Creek.

As observed in wells in the Canyon Creek and Ninemile Creek Watersheds, it is assumed that groundwater levels fluctuate seasonally. Monitoring of groundwater levels along East Fork Moon Creek in the vicinity of the Silver Crescent Mine and Mill site confirmed seasonal variation (Paulsen and Girard 1996). Groundwater levels are generally highest in the late spring and lowest during winter and early spring when precipitation rates are lowest and snowmelt is not occurring.

2.2.2 Aquifer Parameters

Aquifer parameters are not available from the Moon Creek Watershed for the presumed single unconfined aquifer in unconsolidated sediments overlying bedrock. However, based on reported lithologic similarities between the presumed single unconfined aquifer in the Moon Creek

Watershed and the upper aquifer of the Smelterville Flats-Bunker Hill groundwater system, it is reasonable to expect that aquifer parameters presented in Table 2.2-1 are similar to the presumed single unconfined aquifer of the Moon Creek Watershed. This assumption was confirmed by the presence of gravels, cobbles, and sand (as is present in the Smelterville Flats - Bunker Hill area) in thirteen borings completed at the Silver Crescent Mine and Millsite along East Fork Moon Creek (Paulsen and Girard 1996). The range of horizontal hydraulic conductivities presented in Table 2.2-1 are typical of clean sand and gravels (Freeze and Cherry 1979).

2.2.3 Flow Rates and Directions

Based on similar watersheds (e.g., Canyon Creek and Ninemile Creek), it can be assumed that the general groundwater flow direction in the Moon Creek Watershed parallels the flow of Moon Creek surface water. Based on water level data recorded in Canyon Creek, it can be assumed that there are localized areas in Moon Creek where the flow direction is downstream and toward the creek and other areas where the flow direction is downstream and away from the creek.

2.2.4 Surface Water/Groundwater Interaction

Based on groundwater information collected from the Canyon Creek Watershed, it can be assumed that shallow alluvial deposits along Moon Creek serve as aquifers, and if they are hydraulically connected, they are capable of taking from or adding to flow in the creek. It is further assumed that the interaction of the surface water in Moon Creek and groundwater in the shallow alluvial aquifers creates gaining or losing reaches. During the spring snowmelt and resulting high creek levels, the gaining reaches of the stream may temporarily experience reversals in the surface water/groundwater hydraulic gradient (i.e., become losing reaches).

2.2.5 Water Quality and Water Chemistry

Water quality parameters (temperature, pH, specific conductance, salinity, turbidity, and oxidation-reduction [redox] potential) and water chemistry data (e.g., chloride, sulfates, and sulfides) are discussed further in Section 4, Nature and Extent of Contamination and in Section 5, Fate and Transport.

2.2.6 Groundwater Use

Use of groundwater supplies for domestic, municipal, and industrial applications (as it relates to human consumption) is discussed in the baseline human health risk assessment.

2.3 SURFACE WATER HYDROLOGY

The following sections describe the surface water hydrology of Moon Creek, also known as Moon Gulch, a tributary to the South Fork Coeur d'Alene River. The watershed has a drainage area of approximately 9 square miles and approximately 3.8 miles of mapped channel.

2.3.1 Available Information

The available hydrologic information for Moon Creek includes U.S. Geological Survey (USGS) stream flow estimates for water year 1999, climatological data for Kellogg, ID, and instantaneous discharge data from a variety of consultants obtain between 1991 and 1999.

The USGS developed a synthetic hydrograph based on crest stage gage readings and correlation to nearby continuous streamflow record stations for Moon Gulch, Station number 12413190 (USGS 2000). This station is located at the downstream end of MoonCrkSeg02. One year of discharge estimates, water year 1999, is available for Moon Creek. Water year 1999 ran from October 1, 1998 to September 30, 1999. Precipitation data from the Western Regional Climate Center (WRCC) station at Kellogg were collected for the same period (WRCC 2000). This precipitation gage is the nearest gage to Moon Creek. The mean daily discharge hydrograph and precipitation data are presented in Figure 2.3.1-1.

Stream discharge measurements were taken in association with water quality sampling events completed by McCulley, Frick & Gilman, Inc. (MFG), URS, Idaho Department of Environmental Quality (IDEQ), and USGS. These measurements have occurred since 1991. These data are summarized in Table 2.3.1-1.

2.3.2 Hydrologic Description

This section describes the hydrology of Moon Creek. Base flow discharge is estimated at 1 to 2 cubic feet per second (cfs), and average annual discharge is approximately 9 cfs. The maximum mean daily discharge estimated during water year 1999 was 56 cfs, on May 25, 1999.

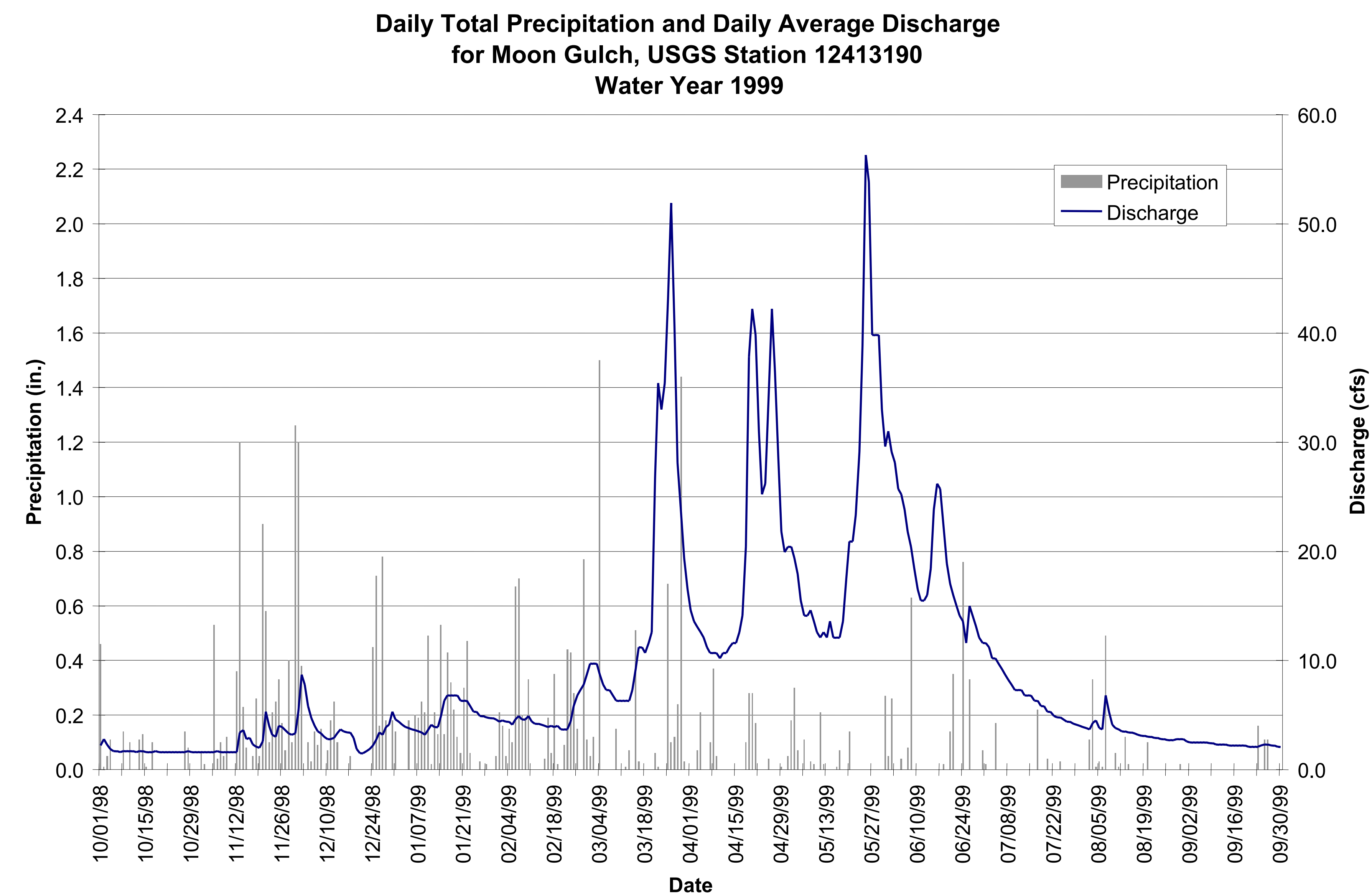
Total annual average precipitation at the WRCC Kellogg Station for the 95-year period of record is 30.8 inches, while for water year 1999 the total precipitation was 37.8 inches (WRCC 2000). Total annual average snowfall for the WRCC station is 54.3 inches, while for water year 1999 the total snowfall was 35.5. While these comparisons do not address monthly variations in precipitation, they do indicate that the water budget for water year 1999 was somewhat typical with above average total precipitation and below average snowfall.

Table 2.3.2-1 summarizes the mean monthly flows Moon Creek, mean monthly precipitation (rain and snow water content), and total snowfall at the WRCC station at Kellogg for water year 1999. Table 2.3.2-1 and Figure 2.3.1-1 indicate the majority of precipitation occurred from October to March (78 percent at the Kellogg gage). Much of this precipitation was in the form of snow and did not run off into the channel immediately. As indicated in Figure 2.3.1-1 and Table 2.3.2-1, stream discharges remained relatively low (less than the annual mean discharge of 9 cfs) through February 1999. In contrast, from March 15 to July 6, stream discharges exceeded the annual mean discharge.

The increase in discharge during the spring and summer is attributed to increased runoff caused by snowmelt. Maximum daily temperature and mean daily discharge for water year 1999 for the Moon Creek are presented in Figure 2.3.2-1. Increased temperatures over these periods melted much of the snow in the upper basin. Rain on snow also may have contributed to these increased discharges as indicated in Figure 2.3.2-1 where precipitation events also occurred during periods of increased temperature.

The discharge range indicated in Table 2.3.1-1 is in the range of values indicated by the water year 1999 hydrograph, with two measurements in excess of the maximum mean daily discharge for water year 1999. On May 28, 1998, IDEQ measured discharges in Moon Creek of 136.9 cfs and on March 8, 1999, IDEQ measured a discharge of 112.5 cfs. These measurements show that discharges in excess of the estimated discharge for water year 1999 should be expected.

Based on the existing data, it is expected that water year 1999 was typical from a total snowfall and total water budget perspective in the Moon Creek Watershed. Runoff from spring snowmelt dominates the surface water hydrology. Variations in snowfall, temperature, and rainfall from year to year will influence the magnitude and timing of peak discharges.



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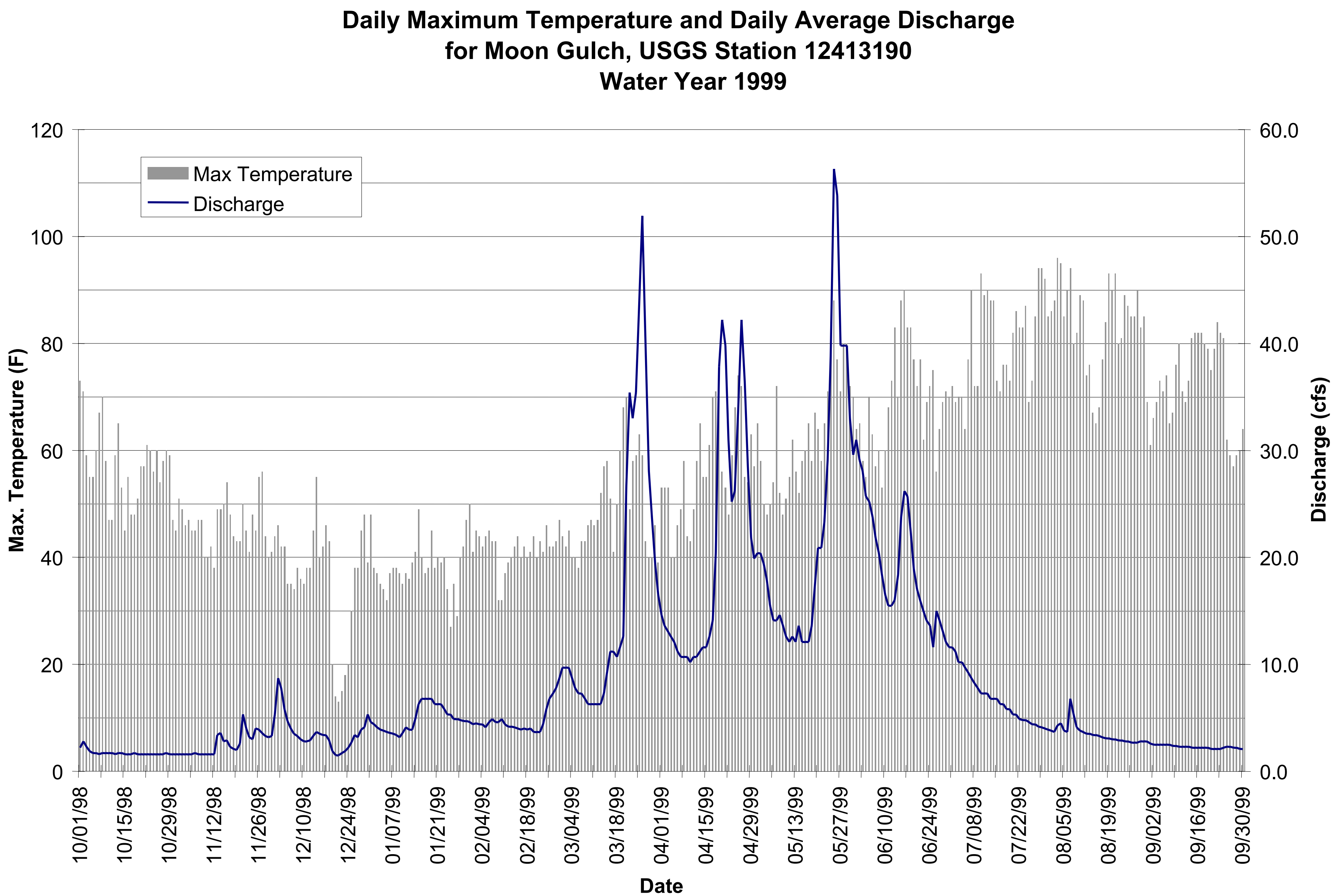


EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Moon Creek Series 07/11/01	**Figure 2.3.2-1**

Table 2.1-1
Mines in the Moon Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Charles Dickens/Silver Crescent Mine					
MoonCrk01	1902-1930	4,604	Charles Dickens	3,803	The Charles Dickens Mine is located at the end of the main road in Moon Gulch. The mine was in operation by 1907, and in 1908 was the largest shipper of ore in the Evolution district. Records by the Idaho State Inspector of Mines report ore production of 4,604 tons from 1902 through 1930. Some development work was conducted during 1930, but the mine was idle for much of 1930 through 1937. The mine was again active in 1937-1938, 1948-1950, and possibly 1963-1964. There is little other historical mention of the site until the *68th Annual Report of the Mining Industry in Idaho for 1969-1970* listed the site as idle. The mill and other on-site structures were dismantled in 1996 and 1997 (Ridolfi 1998). The Silver Crescent Mine was incorporated in 1911. Records by the Idaho State Inspector of Mines report development activity at the mine between 1911 and 1926, however there is no record of production during this time. The mine remained idle after 1926 until the mine's merger with the Charles Dickens in 1937 (Ridolfi, 1998).

Source: Stratus 1999, unless otherwise noted.

Table 2.1-2
Mills With Documented Operations in Moon Creek Watershed

Segment	Operating Years	Ownership	Comments
Charles Dickens			
MoonCrk01	1907-1908 1908-1928 1928-1948	Charles Dickens, Silver Crescent	The Charles Dickens built a 100-ton concentrator on the property in 1907. The mill was destroyed the next year and was replaced with a 150-ton mill. The property was sold shortly thereafter and was operated only intermittently until about 1925. In 1928, the 150-ton jig concentrator was replaced with a 150-ton flotation mill. The mill operated through 1928 but for only a short period in 1929 before the mill was damaged by fire. There is no record of the mill operating after this time until 1940. The mill was operated intermittently through the 1940s, processing ore from the Silver Dollar Mining Company at Terror Gulch and reprocessing tailings from various sources. There is little other historical mention of the site until the *68th Annual Report of the Mining Industry in Idaho for 1969-1970* listed the site as idle. The mill and other on-site structures were dismantled in 1996 and 1997 (Ridolfi 1998).

Source: Ridolfi 1998

Table 2.2-1
Summary of Aquifer Parameters of the Smelterville Flats-Bunker Hill Upper Aquifer

Hydro-stratigraphic Unit	Horizontal Hydraulic Conductivity (ft/day)	Vertical Hydraulic Conductivity (ft/day)	Transmissivity 2 (ft/day)	Storativity (unitless)	Effective Porosity
Upper Aquifer	500 - 10,790	0.0025[a]	10,002-216,852	0.0015-0.09	23.6-29.0

[a]Based on one test conducted on a sample of upper aquifer alluvium from borehole GR-26U (see Part 1, Figure 3.2-1) at 13.5 feet below ground surface. No units given in original source document.
Source: MFG (1992)

Table 2.3.1-1
Summary of Discharge Data From Project Database
Segment MoonCrkSeg02

Segment Name	Site Location	Measured By	No. of Readings	Beginning Date	Ending Date	Minimum Discharge	Maximum Discharge	Units
MoonCrkSeg02	MC 262	IDEQ, MFG, URS, USGS	68	05/14/91	08/31/99	0.38	136.95	cfs

cfs - cubic feet per second

Table 2.3.2-1
Precipitation Summary and Discharge Comparison for Water Year 1999
Kellogg, Idaho
NOAA Cooperative Station 104831

Climate Indicators	Monthly Totals												Annual Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Total Precipitaiton (in.)	1.4	7.5	5.3	4.6	5.7	5.1	1.7	1.5	2.7	0.5	1.3	0.4	37.8
Total Snowfall (in.)	0.0	0.8	11.0	5.2	13.1	5.1	0.3	0.0	0.0	0.0	0.0	0.0	35.5
Mean Monthly Discharge (cfs) (Moon Gulch)	1.7	2.6	3.6	4.9	4.8	17.0	20.2	22.8	19.2	6.7	3.5	2.3	9.1
Average Precipitation for Period of Record (in.)	2.7	3.8	3.9	3.7	2.8	2.9	2.4	2.5	2.2	1.0	1.1	1.7	30.8
Average Snowfall for Period of Record (in.)	0.3	5.0	14.1	18.5	10.1	5.6	0.7	0.0	0.0	0.0	0.0	0.0	54.3

cfs - cubic feet per second

3.0 SEDIMENT TRANSPORT PROCESSES

Sediment derived in Moon Creek is transported into the South Fork approximately 3 miles upstream of Kellogg, Idaho. Based on review of aerial photographs, sediment sources in Moon Creek are mining waste, mobilization of channel bed sediment, bank erosion, and some rock debris situated adjacent to channels. In this discussion, the available information, analyses, and likely sediment sources are described.

3.1 AVAILABLE INFORMATION

Sediment transport gaging data are not available for Moon Creek; therefore, estimates of sediment yield are not provided in this report.

For Moon Creek, 1998 photographs by URS Greiner, Inc. (URSG) and CH2M HILL (URSG and CH2M HILL 1999) were reviewed. Channel descriptions and potential sediment sources are described below.

3.2 ANALYSES

3.2.1 Channel Descriptions

The 1998 set of aerial photographs by URSG and CH2M HILL were reviewed to describe Moon Creek. This review and interpretation focused on morphologic features indicating stream instability, channel migration, channel aggregation or degradation and other features that may contribute sediment to the system.

3.2.1.1 MoonCrkSeg01

The West Fork of Moon Creek is contained within MoonCrkSeg01. It has a drainage area of approximately 3.6 square miles. Based on the aerial photographs reviewed, no major sources of sediment are contained in MoonCrkSeg01. The channel is contained in a narrow valley by well vegetated hillslopes. Likely sediment sources in MoonCrkSeg01 are channel bed remobilization and minor bank erosion.

3.2.1.2 MoonCrkSeg02

MoonCrkSeg02 has a drainage area of approximately 5.4 square miles. From the mouth to the confluence with the West Fork, the channel is situated in a valley floor 100 to 200 feet wide. The channel appears to be confined to the current location by road embankments and culverts. The channel banks are moderately well vegetated for much of this reach. Many high gradient ephemeral channels enter in this section of channel. About 3,000 feet downstream of the West Fork confluence, the valley decreases in width. Approximately 2,000 feet downstream of the confluence with the West Fork, a small road cut is apparent in the photographs reviewed. This may constitute a sediment source, provided a surface water connection exists.

Upstream of the West Fork Confluence, the channel is confined in general location by steep valley walls and road embankments. Approximately 4,000 feet upstream of the West Fork confluence and continuing 2,000 to 3,000 feet upstream, Moon Creek flows adjacent to rock piles and tailings ponds of both the Charles Dickens Mine and Silver Crescent Mill site. If a surface water connection exists between the channel and exposed rock or soil, this area may contribute sediment to the system.

Likely sediment sources in MoonCrkSeg02 are channel bed remobilization and minor bank erosion. The rock debris piles in and around both the Charles Dickens Mine and Silver Crescent Mill site also may contribute to the sediment load.

3.3 SUMMARY

The Moon Creek Watershed appears to have few sediment sources. Likely sediment sources throughout the basin include channel bed remobilization, and minor bank erosion. Some sediment may be contributed at the rock and debris piles adjacent to the channel in MoonCrkSeg02; however, these appear less significant than other areas in the Coeur d'Alene Basin.

These observations were based on a limited review of the available data, photographs, and topographic maps at the time of review. Not all potential sediment sources were identified as potential sediment sources literally cover the entire watershed. Primary sources were identified based on review of the available information.

4.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination and mass loading in the two segments of the Moon Creek watershed are discussed in this section. Section 4.1 describes chemical concentrations found in environmental media, including horizontal and vertical extent. For each watershed segment, the discussion includes remedial investigation data chemical analysis results; comparison of chemical results to selected screening levels (Part 1, Section 5.1); and focused analysis of identified source areas. In Section 4.2, preliminary estimates of mass loading are presented.

4.1 NATURE AND EXTENT

The nature and extent of the ten metals of potential concern identified in Part 1, Section 5.1 (antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc) in surface soil, subsurface soil, sediment, groundwater, and surface water are discussed in this section. Locations with metals detected in any matrix at concentrations 1 times (1x), 10 times (10x), and 100 times (100x), the screening level were identified and presented in the following data summary tables. The magnitudes of exceedence (10x and 100x) were arbitrarily selected to delineate areas of contamination. Metals identified in this evaluation are further evaluated in either the human health or ecological risk assessments (under separate cover).

Historical and recent investigations at areas within the study area are listed and summarized in Part 1, Section 4. Data source references are included as Attachment 1. Chemical data collected in Moon Creek and used in this evaluation are presented at the end of this report. Data summary tables include sampling location, data source reference, collection date, depth, and reported concentration. Screening level exceedences are highlighted. Sampling locations are shown on Figures 4.1-1 through 4.1-3. All chemical data collected and compiled for this study are included in Attachment 2.

The nature and extent of contamination were evaluated by screening chemical results against applicable risk-based screening criteria and available background concentrations. Screening levels are used in this analysis to identify source areas and media (e.g., soil, sediment, groundwater, and surface water) of concern that will be evaluated in the feasibility study (FS).

Statistical summaries for each metal in surface soil, subsurface soil, sediment, groundwater, and surface water are included as Attachment 3 and discussed in the subsections below. The summaries include the number of samples analyzed; the number of detections; the minimum and maximum detected concentrations; the average and coefficient of variation; and the screening level (SL) to which the detected concentration is compared. Proposed screening levels were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional baseline or background studies for soil, sediment, and surface water, and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). The screening level selection process is discussed in detail in Part 1, Section 5.1.

Source areas within Moon Creek are presented in Tables 4.1-1and 4.1-2. These sites are based source areas initially identified by the BLM (1999) and further refined by CH2MHILL and URS during the RI/FS process. The tables include source area names, source ID, source area acres, description, number of samples by matrix type, and metals exceeding 1x, 10x, and 100x the screening levels in surface soil, subsurface soil, sediment, groundwater, and surface water. Surface water results are discussed in Mass Loading (Section 4.2). This table reflects source area descriptive measurements initially generated in the CSM and subsequently refined by the FS.

It should be noted that the number of samples identified for each source area was determined using the project Geographical Information System. Only sampling locations located within a source area polygon (shown on Figures 4.1-1 through 4.1-3) are included in Tables 4.1-1 and 4.1-2; therefore, there may be samples collected from source areas and listed in the data summary tables in Attachment 2 that are not accounted for in Tables 4.1-1 and 4.1-2.

The following sections present segment-specific sampling efforts and results according to matrix type. Given the extensive geographic range of the Coeur d'Alene Basin, sampling efforts were focused on areas of potential concern; therefore, more samples were collected from known mining-impacted areas near the creek, than from other areas within the watershed.

4.1.1 Segment MoonCrkSeg01

4.1.1.1 Surface Soil

One surface soil sample was collected and analyzed for total metals in segment MoonCrkSeg01. Arsenic was detected at a concentration greater than 10x the screening level.

4.1.1.2 Identified Source Areas

Summary source area data are presented in Table 4.1-1. Two source areas occur in this segment. Two surface soil samples were collected from an unnamed tunnel. Arsenic was detected at a concentration greater than 10x the screening level.

4.1.2 Segment MoonCrkSeg02

4.1.2.1 Surface Soil

Three surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. Arsenic, cadmium, copper, lead, and zinc were detected at concentrations greater than 10x the screening levels.

4.1.2.2 Surface Water

Ninety-three surface water samples were collected and analyzed in segment MoonCrkSeg02 for total and dissolved metals. Zinc was detected at a concentration exceeding 10x the screening level in two total metals samples. Dissolved lead was detected at a concentration greater than 10x the screening level in one sample.

4.1.2.3 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment MoonCrkSeg02 that may be significant contributors of metals to Moon Creek. Summary source area data are presented in Table 4.1-2.

Three of the 12 source areas in this segment were sampled for surface soil and a fourth source area was sampled for surface water. Surface soil concentrations greater than 10x the screening levels were detected for arsenic, cadmium, copper, lead, and zinc. Surface water concentrations exceeded 10x the screening levels for dissolved lead and total zinc.

4.2 SURFACE WATER MASS LOADING

In Part 1 of this report (Setting and Methodology, Section 5.3.1), the concept of mass loading and its use in the remedial investigation was presented. Section 4.2 of the Canyon Creek Nature and

Extent further discussed the use of plotting discrete sampling events versus the probabilistic analysis of the mass loading data in Fate and Transport.

The Moon Creek Watershed has very limited data by which to assess mass loading in surface water or groundwater. As summarized in Table 4.2-1, there is one data point for which total lead and dissolved zinc mass loading can be calculated. This sampling location is in Moon Creek, close to the confluence with the South Fork.

A review of the lead loading data in Table 4.2-1 indicates that the total lead mass load ranges from less than 1 pound per day to 17 pounds per day (April 16, 1997). As shown in the table, lead load increases with flow.

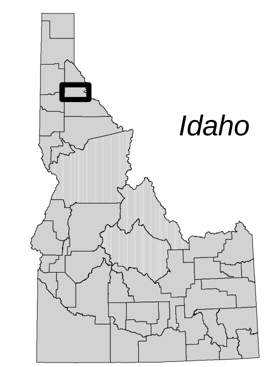
A review of the zinc loading in Table 4.2-1 indicates that the dissolved zinc mass load ranges from less than 1 pound per day to 179 pounds per day (February 21, 1997). As shown in the table, zinc load increases with flow.

Based on the data in Table 4.2-1, relative to other tributaries, the discharge from Moon Creek does not add substantial total lead and dissolved zinc load to the South Fork. There are floodplain deposits in segment MoonCrkSeg02 that could act as a pathway for metal migration in groundwater. Current information is not sufficient to evaluate the contributions of metals from groundwater to surface water loading.

Figure 4.1-1
Moon Creek Segment MoonCrkSeg01
Source Areas and Soil/Sediment
Sampling Locations

LEGEND

- Tailings Sampling Location
- Stream
- Road
- City
- Moon Creek Segment 1
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

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Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

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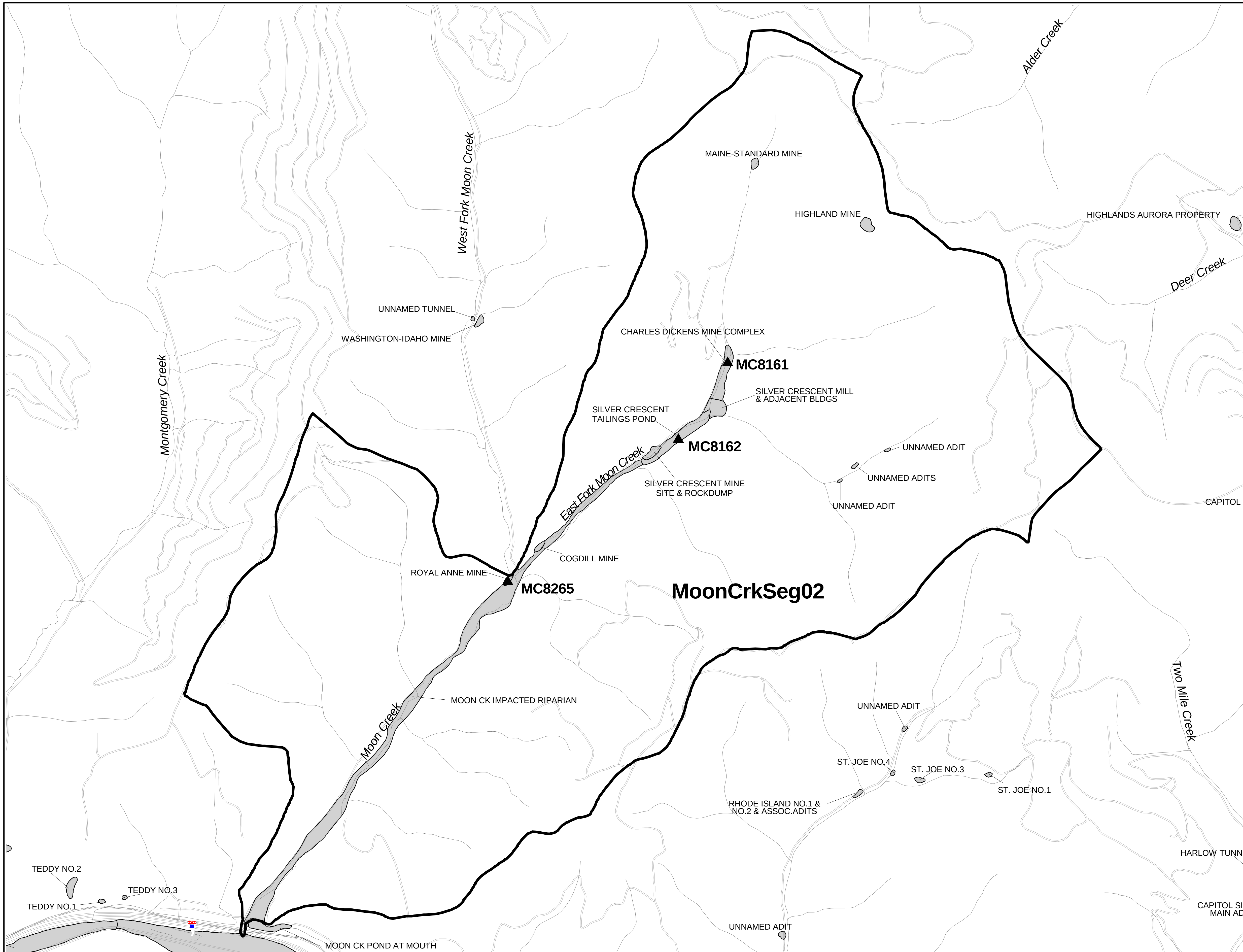
V: MoonCrkSeg01 Soil
E:soil
L: Final RI MoonCrkSeg01 soil
7/11/2001

This Map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

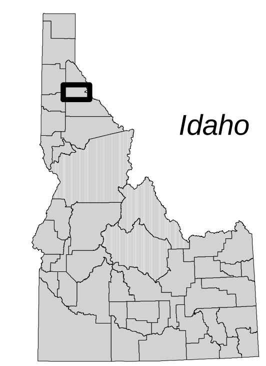
Date of Plot: July 11, 2001

Figure 4.1-2
Moon Creek Segment MoonCrkSeg02 Source Areas and Soil/Sediment Sampling Locations



LEGEND

- ▲ Tailings Sampling Location
- Stream
- Road
- Interstate 90
- ★ City
- Moon Creek Segment 2
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

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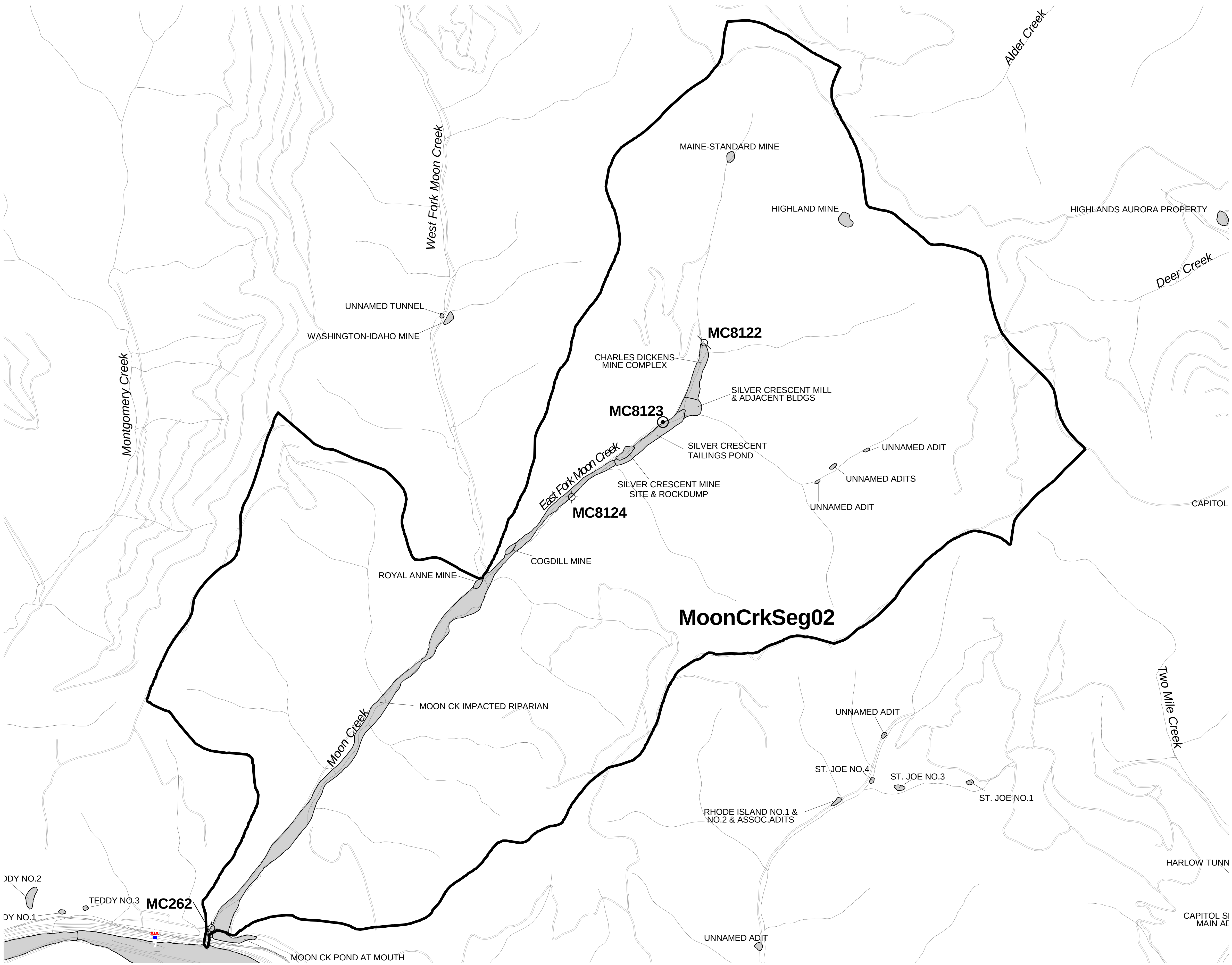
V: MoonCrkSeg02 soil
E:soil
L: Final RI MoonCrkSeg02 soil
7/11/2001

This Map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

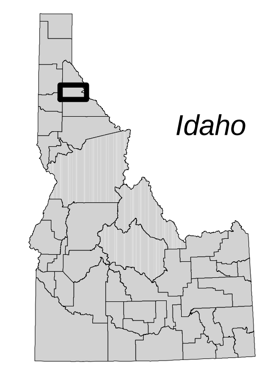
Date of Plot: July 11, 2001

Figure 4.1-3
Moon Creek Segment MoonCrkSeg02
Source Areas and Surface Water
Sampling Locations



LEGEND

- Adit Sampling Location
- River Sampling Location
- Seep Sampling Location
- Stream
- Road
- City
- Moon Creek Segment 2
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:24,000

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RI REPORT

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V: MoonCrkSeg02 SW
E:surface water
L: Final RI MoonCrkSeg02 SW
7/11/2001

This Map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983

Date of Plot: July 11, 2001

Table 4.1-1
Potential Source Areas Within Moon Creek - segment MoonCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
UNNAMED TUNNEL	KLE061	0.13	Floodplain waste rock	SL	1	SST: Cd-1, Pb-1, Zn-1	SST: As-1	
WASHINGTON-IDAHO MINE	KLE007	0.62	Upland waste rock					

Matrix Types

DR: Debris/Rubble	SD: Sediment
GW: Groundwater	SL: Soil
RK: Rock/Cobbles/Gravel	SS: Surface Soil
SB: Subsurface Soil	SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals	SST: Surface Soil
GWT: Groundwater - Total Metals	SWD: Surface Water - Dissolved Metals
SBT: Subsurface Soil	SWT: Surface Water - Total Metals
SDT: Sediment	

Analytes

Ag: Silver	Hg: Mercury
As: Arsenic	Mn: Manganese
Cd: Cadmium	Pb: Lead
Cu: Copper	Sb: Antimony
Fe: Iron	Zn: Zinc

Table 4.1-2
Potential Source Areas Within Moon Creek - segment MoonCrkSeg02

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
CHARLES DICKENS MINE COMPLEX	KLE078	4.93	Upland waste rock	SL	1	SST: Fe-1	SST: As-1, Cd-1, Cu-1, Pb-1, Zn-1	
COGDILL MINE	KLE013	0.53	Upland waste rock					
HIGHLAND MINE	KLE009	1.38	Upland waste rock					
MAINE-STANDARD MINE	KLE008	0.65	Upland waste rock (erosion potential)					
MOON CK IMPACTED RIPARIAN	KLE041	49.62	Floodplain sediments	SW	91	SWD: Cd-79, Pb-33, Zn-89 SWT: Cd-1, Cu-1, Pb-2, Zn-89	SWD: Pb-1 SWT: Zn-1	
ROYAL ANNE MINE	KLE014	0.49	Upland waste rock (erosion potential)	SL	1	SST: Cu-1, Fe-1, Pb-1	SST: As-1	
SILVER CRESCENT MILL & ADJACENT BLDGS	KLE077	2.98	Upland tailings					
SILVER CRESCENT MINE SITE & ROCKDUMP	KLE076	1.18	Adit drainage Upland waste rock					
SILVER CRESCENT TAILINGS PONDS	KLE012	6.39	Floodplain tailings	SL	1	SST: Cu-1, Zn-1	SST: As-1, Pb-1	
UNNAMED ADIT	KLE063	0.15	Upland waste rock (erosion potential)					
UNNAMED ADIT	KLE064	0.13	Upland waste rock (erosion potential)					
UNNAMED ADITS	KLE065	0.23	Upland waste rock (erosion potential)					

Matrix Types

DR: Debris/Rubble
GW: Groundwater
RK: Rock/Cobbles/Gravel
SB: Subsurface Soil
SD: Sediment
SL: Soil
SS: Surface Soil
SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals
GWT: Groundwater - Total Metals
SBT: Subsurface Soil
SDT: Sediment
SST: Surface Soil
SWD: Surface Water - Dissolved Metals
SWT: Surface Water - Total Metals

Analytes

Ag: Silver
As: Arsenic
Cd: Cadmium
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Pb: Lead
Sb: Antimony
Zn: Zinc

Table 4.2-1
Mass Loading Moon Creek

Location	Segment	Sample Type	Sample No.	Sample Date	Flow (CFS)	Total Lead Conc. (μg/L)	Total Lead Load (lbs/day)	Dissolved Zinc Conc. (μg/L)	Dissolved Zinc Load (lbs/day)
MC262	2	RV	172069	14-May-91	14.9	4	0.3	102	8.2
MC262	2	RV	172104	01-Oct-91	0.9	5	0.0	84	0.4
MC262	2	RV	173575	29-Oct-93	2.5	2.5 U	-	160	2.1
MC262	2	RV	173576	01-Dec-93	2.7	2.5 U	-	160	2.3
MC262	2	RV	173577	21-Dec-93	2.2	7	0.1	187	2.2
MC262	2	RV	173577	21-Dec-93	3.1	7	0.1	187	3.1
MC262	2	RV	173578	21-Jan-94	7.1	2.5 U	-	160	6.1
MC262	2	RV	173578	21-Jan-94	7.1	2.5 U	-	160	6.1
MC262	2	RV	173579	17-Feb-94	3.8	2.5 U	-	156	3.2
MC262	2	RV	173580	07-Mar-94	23.2	2.5 U	-	114	14.3
MC262	2	RV	173581	23-Mar-94	15.3	2.5 U	-	119	9.8
MC262	2	RV	173581	23-Mar-94	16.0	2.5 U	-	119	10.3
MC262	2	RV	173582	06-Apr-94	14.0	2.5 U	-	101	7.6
MC262	2	RV	173583	18-Apr-94	10.6	2.5 U	-	97	5.6
MC262	2	RV	173584	03-May-94	6.2	2.5 U	-	104	3.5
MC262	2	RV	173585	20-May-94	4.3	2.5 U	-	127	3.0
MC262	2	RV	173586	07-Jun-94	4.3	2.5 U	-	141	3.3
MC262	2	RV	173587	24-Jun-94	2.8	2.5 U	-	121	1.8
MC262	2	RV	173588	22-Jul-94	2.0	2.5 U	-	104	1.1
MC262	2	RV	173589	17-Aug-94	0.4	2.5 U	-	74	0.2
MC262	2	RV	173589	17-Aug-94	1.4	2.5 U	-	74	0.6
MC262	2	RV	173591	05-Oct-94	1.8	2.5 U	-	78	0.7
MC262	2	RV	173592	16-Nov-94	3.8	2.5 U	-	152	3.1
MC262	2	RV	173593	14-Dec-94	3.5	2.5 U	-	159	3.0
MC262	2	RV	173594	10-Jan-95	8.5	2.5 U	-	160	7.3
MC262	2	RV	173595	09-Feb-95	62.8	2.5 U	-	114	38.6
MC262	2	RV	173596	08-Mar-95	112.5	2.5 U	-	120	72.7
MC262	2	RV	173597	22-Mar-95	79.9	7	3.0	113	48.7
MC262	2	RV	173598	12-Apr-95	16.0	6	0.5	117	10.1
MC262	2	RV	173599	25-Apr-95	14.6	7	0.6	114	9.0
MC262	2	RV	173600	09-May-95	6.8	7	0.3	128	4.7
MC262	2	RV	173601	23-May-95	4.2	2.5 U	-	125	2.8
MC262	2	RV	173602	12-Jun-95	4.2	5 J	-	134	3.0
MC262	2	RV	173603	27-Jun-95	2.9	7	0.1	96	1.5
MC262	2	RV	173604	11-Jul-95	2.8	2.5 U	-	139	2.1
MC262	2	RV	173605	25-Jul-95	2.1	6	0.1	106	1.2
MC262	2	RV	173606	14-Aug-95	1.8	5 J	-	226	2.2
MC262	2	RV	173607	13-Sep-95	1.8	7	0.1	110	1.0
MC262	2	RV	173608	18-Oct-95	8.9	5 J	-	174	8.3
MC262	2	RV	173609	21-Nov-95	8.9	6	0.3	164	7.8
MC262	2	RV	173612	28-Feb-96	130.0	6	4.2	125	87.6
MC262	2	RV	173613	27-Mar-96	62.8	2.5 U	-	198	67.0
MC262	2	RV	173614	17-Apr-96	97.1	10	5.2	154	80.6
MC262	2	RV	173615	08-May-96	69.1	8	3.0	125	46.6
MC262	2	RV	173616	19-Jun-96	18.4	5 J	-	144	14.3

Table 4.2-1 (continued)
Mass Loading Moon Creek

Location	Segment	Sample Type	Sample No.	Sample Date	Flow (CFS)	Total Lead Conc. (µg/L)	Total Lead Load (lbs/day)	Dissolved Zinc Conc. (µg/L)	Dissolved Zinc Load (lbs/day)
MC262	2	RV	173618	21-Aug-96	7.4	15	0.6	86	3.4
MC262	2	RV	173619	26-Sep-96	5.0	2.5 U	-	110	2.9
MC262	2	RV	186012	29-Oct-96	11.1	5	0.3	115	6.9
MC262	2	RV	186023	26-Nov-96	11.1	7	0.4	146	8.7
MC262	2	RV	186039	13-Dec-96	30.8	2.5	0.4	152	25.2
MC262	2	RV	186056	29-Jan-97	18.4	2.5	0.2	129	12.8
MC262	2	RV	186073	21-Feb-97	276.0	6	8.9	120	178.5
MC262	2	RV	186093	26-Mar-97	18.4	0.06	0.0	106	10.5
MC262	2	RV	186113	16-Apr-97	124.0	26	17.3	105	70.2
MC262	2	RV	186153	23-Jun-97	6.8	8	0.3	166	6.1
MC262	2	RV	186173	23-Jul-97	24.3	7	0.9	156	20.4
MC262	2	RV	186193	14-Aug-97	10.2	2.5	0.1	111	6.1
MC262	2	RV	186213	03-Sep-97	9.7	2.5	0.1	92	4.8
MC262	2	RV	186233	16-Oct-97	2.6	2.5	0.0	120	1.7
MC262	2	RV	168465	05-Nov-97	2.4	0.47 J	-	130	1.7
MC262	2	RV	186253	24-Nov-97	4.3	2.5	0.1	132	3.1
MC262	2	RV	186272	17-Dec-97	3.2	2.5	0.0	154	2.7
MC262	2	RV	186291	21-Jan-98	4.3	4	0.1	142	3.3
MC262	2	RV	186310	25-Feb-98	14.6	2.5	0.2	110	8.7
MC262	2	RV	186329	20-Mar-98	30.8	2.5	0.4	111	18.4
MC262	2	RV	186348	23-Apr-98	14.6	2.5	0.2	151	11.9
MC262	2	RV	46324	05-May-98	6.9	2.6	0.1	318	11.8
MC262	2	RV	202240	28-May-98	136.9	12	8.8	99	73.1
MC262	2	RV	202254	25-Jun-98	7.1	5 U	-	138	5.3
MC262	2	RV	202275	27-Jul-98	3.2	5 U	-	87	1.5
MC262	2	RV	202295	25-Aug-98	2.6	6	0.1	84	1.2
MC262	2	RV	202365	24-Sep-98	2.5	5 U	-	100	1.3
MC262	2	RV	186945	28-Oct-98	1.3	2	0.0	127	0.9
MC262	2	RV	186946	18-Nov-98	1.6	2	0.0	123	1.1
MC262	2	RV	186947	14-Dec-98	4.8	2	0.1	167	4.3
MC262	2	RV	186948	21-Jan-99	21.0	3	0.3	0.101	0.0
MC262	2	RV	186949	22-Mar-99	63.0	47	15.9	57	19.4
MC262	2	RV	186950	20-Apr-99	43.0	5	1.2	45	10.4
MC262	2	RV	186951	04-May-99	17.0	1	0.1	56	5.1
MC262	2	RV	186952	23-May-99	8.7		-	61	2.9
MC262	2	RV	186953	16-Jun-99	4.2	1	0.0	74	1.7
MC262	2	RV	202173	20-Jul-99	2.1	0.49	0.0	93	1.1
MC262	2	RV	202174	04-Aug-99	1.5	0.34	0.0	81	0.7
MC262	2	RV	202175	31-Aug-99	1.4	0.6	0.0	85	0.6

Notes:
- : No data or delta not calculated

RV: River Sample
CFS: Cubic feet per Second

µg/L: Micrograms per liter
lbs/day: pounds per day
U: not detected
J: estimated concentration

5.0 FATE AND TRANSPORT

The fate and transport of metals in surface water, groundwater, and sediment in the Moon Creek Watershed are discussed in this section. A conceptual model of fate and transport, important fate and transport mechanisms, and a summary of the probabilistic model developed to evaluate fate and transport, were presented in the fate and transport section in the Canyon Creek report and are not repeated here. This section draws upon that general information.

Initial findings on metals concentrations and mass loading for each segment, as presented above in Section 4, Nature and Extent, are briefly summarized in Section 5.1. Results of the probabilistic modeling are presented in Section 5.2. Sediment transport is summarized in Section 5.3. A summary of fate and transport of metals in Moon Creek is presented in Section 5.4.

5.1 INTRODUCTION

The lowest and highest dissolved cadmium and zinc and total lead loadings measured during six sampling events (May, 1991; October, 1991; November, 1997; May, 1998; November, 1998; and May, 1999) are listed in Table 5.1-1. Potential sources of these metals in the watershed were identified for each segment in Section 4.1 and preliminary mass loading estimates were discussed in Section 4.2. Brief summaries of those results are included in this section.

Segment MoonCrkSeg01 contains the headwaters of the West Fork of Moon Creek down to its confluence with Moon Creek. The BLM identified two source areas in this segment. This segment has been relatively unaffected by mining activities. No surface water data are available for this segment.

Segment MoonCrkSeg02 contains the headwaters of Moon Creek and continues down the main stem of Moon Creek to its confluence with the South Fork. The BLM identified 12 source areas in this segment. Mining and release of tailings from the Crescent Mine and the Charles Dickens Mine on the East Fork have caused the deposition of mining waste on the narrow floodplain of the lower part of Moon Creek. Remediation work has been implemented at the above sites. Sampling of surface water indicates that metals concentrations in surface water are greater than screening levels. Preliminary calculations of mass loading indicated minimal loading of cadmium and lead. The maximum calculated zinc load was 178.5 pounds per day (CH2M HILL 1998).

5.2 MODEL RESULTS

Results from the probabilistic model are discussed for cadmium, lead, and zinc in this section. Modeling results for estimates of discharge are discussed in Section 5.2.1. Modeling results for estimates of chemical concentrations and mass loading of cadmium, lead, and zinc are discussed in Section 5.2.2. Modeling results are summarized in Table 5.2-1. All modeling results are included in Appendix C.

Sufficient data ($10 samples) were available for one sampling location, MC262. Only sampling locations with 10 or more individual data points for each parameter of interest were evaluated. Sampling location MC262 is shown on Figure 4.1-3. This sampling location is located immediately upstream of the confluence of Moon Creek with the South Fork.

5.2.1 Estimated Discharge

A lognormal plot of discharge data at sampling location MC262 at the mouth of Moon Creek is shown in Figure 5.2-1. In Figure 5.2-1, the discharge in cubic feet per second is plotted on a log scale versus the normal standard variate. The normal standard variate is equivalent to the standard deviation for a normalized variable. When the log of a variable (e.g., discharge) is plotted versus the standard normal variate, a straight line will result if the data are lognormally distributed. The cumulative distribution function gives the probability that the observed discharge at any given time will not be exceeded by the estimated discharge at that cumulative probability. The cumulative distribution function is plotted versus the normal standard variate in Figure 5.2-2. To determine the probability of occurrence of a specific discharge, first select the discharge of interest on Figure 5.2-1, then find its corresponding normal standard variate. Using that value for the normal standard variate, look up its corresponding cumulative probability in Figure 5.2-2. For example, for a discharge of 10 cfs, the normal standard variate is approximately 0.3 (Figure 5.2-1). Looking on Figure 5.2-2, this value corresponds to a cumulative probability of approximately 0.62; therefore, approximately 62 percent of the time, discharges at this location will be 10 cfs or less.

The probability distribution function (PDF) shown in Figure 5.2-1 is a predictive tool that can be used to estimate the expected discharge and provide a quantitative estimate of the probability that the observed discharge will not exceed a given value. Conversely, one can find the estimated discharge rate having a specified probability of exceedance or non-exceedance by the observed discharge.

As shown in Figure 5.2-1, there is a good fit of the lognormal regression line (solid line in Figure 5.2-1) to the data. This goodness of fit, as evidenced by a high coefficient of determination ($r^2 = 0.95$), supports the assumption that discharges are lognormally distributed. The dotted line represents a lognormal distribution generated using the coefficient of variation (CV, standard deviation divided by the average) and expected value of the actual data.

The discharge rate having a specific probability of exceedence or non-exceedence by an actual discharge may also be estimated by using the relationships shown in Figure 5.2-1. The estimated expected value of the discharge at the mouth of Moon Creek is approximately 13.2 cfs. Approximately one-quarter of the discharge data points lie above the expected discharge.

5.2.2 Estimated Zinc, Lead, and Cadmium Concentrations and Mass Loading

Dissolved cadmium and zinc, and total lead concentrations and loads were evaluated using the probabilistic model at the sampling location (MC262) that contained a minimum of ten data points.

The lognormal distribution of dissolved zinc, total lead, and dissolved cadmium concentrations and dissolved zinc and cadmium and total lead loading at sampling location MC262 are shown in Figures 5.2-3 through 5.2-8. The data follow a lognormal distribution as shown by the high r-squared values (r^2). For dissolved concentrations, the r-squared values for zinc and cadmium were 0.97 and 0.93, respectively. The corresponding value for the lognormal regression plot of total lead concentrations was 0.94. The corresponding values for dissolved zinc and cadmium and total lead loads were 0.93, 0.99, and 0.91, respectively, when loads were plotted lognormally. All the r-squared values were significant at a < 0.0001.

To assist in interpreting and placing the results in context, screening levels and expected values are shown on the figures when appropriate. The screening level for dissolved cadmium in surface waters is 0.38 µg/L. Approximately 20 percent of the cadmium concentrations at MC262 are greater than this screening level. No dissolved cadmium concentrations exceeded 10 times the screening level (Figure 5.2-3). The estimated expected dissolved cadmium concentration (0.68 µg/L) is greater than the screening level.

All measured total lead concentrations except one fall below the screening level (15 µg/L). The estimated expected lead concentration (approximately 3.7 µg/L) is also less than the screening level (Figure 5.2-4).

All dissolved zinc concentrations (Figure 5.2-5) measured at sampling location MC262 exceed the screening level of 42 µg/L. All measured data for dissolved zinc fall between the screening level and 10 times the screening level. The estimated expected dissolved zinc concentration (121 µg/L) exceeds by approximately 3-fold the dissolved zinc screening level.

No total maximum daily loads (TMDLs) were established for mass loading at the mouth of Moon Creek (USEPA 2000). Accordingly, no TMDLs were available to compare actual loadings with established criteria. The estimated dissolved zinc load at the mouth of Moon Creek is approximately 9.9 pounds/day. The estimated expected value for total lead loading is approximately 0.42 pounds/day. Approximately 20 percent of the data points exceed the estimated value of lead loading. The estimated expected value for dissolved cadmium loading is 0.0466 pounds/day. Approximately 25 percent of the data exceed the estimated expected value.

5.2.2.1 Segment MoonCrkSeg01

Segment MoonCrkSeg01 encompasses the West Fork Moon Creek watershed. This segment has few potential sources of mining waste and is relatively unaffected. The Washington-Idaho mine is found in this segment.

5.2.2.2 Segment MoonCrkSeg02

Segment MoonCrkSeg02 includes the headwaters and the main stem of Moon Creek. Potential sources in this segment include the Silver Crescent mine and mill complex and the Charles Dickens mine complex. Mining and release of tailings from mill sites adjacent to Moon Creek have resulted in deposition of mining wastes on the narrow floodplain of the lower part of Moon Creek. Concentrations of dissolved zinc in Moon Creek in this segment exceed screening levels by two to three times. Remedial actions at the Silver Crescent mine and mill complex have recently been completed by the U.S. Forest Service. At this time, the effects of these actions on metal loadings and concentrations at the mouth of Moon Creek are unknown.

Data from one sampling location in this segment, MC262, situated at the mouth of Moon Creek, was analyzed probabilistically.

The estimated expected value for dissolved cadmium is 0.68 µg/L, which is greater than the screening level of 0.38 µg/L. The estimated expected value of the dissolved cadmium load is 0.0466 pounds/day.

The estimated value of the total lead concentration is 3.7 µg/L, which is less than the screening level of 15 µg/L. The estimated total lead load is 0.42 pounds/day.

The estimated expected value of the dissolved zinc concentration at this location is approximately 121 µg/L, which exceeds the screening level (42 µg/L) by more than three times. The estimated expected value of the dissolved zinc load is approximately 9.9 pounds/day.

5.2.2.3 Concentrations Versus Discharge

The following discussion is based on evaluation of data at the mouth of Moon Creek (MC262). There was a negative correlation between a regression plot of the log of the dissolved zinc concentrations versus discharges (concentrations decreased as discharges increased) which is significant at a = < 0.10 (a is the probability the correlation is due to chance). As one would expect, given that the majority of the zinc is in the dissolved phase, there was also a decrease in total zinc concentrations with increased discharge rates which was significant at a= < 0.32. Total lead concentrations increased with increasing discharge (a < 0.001). Estimated values of dissolved (a < 0.10) cadmium concentrations increased with increased discharge at the mouth of Moon Creek.

5.3 SEDIMENT FATE AND TRANSPORT

Sediment fate and transport processes were presented in Section 3. Results of the sediment transport evaluation presented in Section 3 are summarized in this section.

Sediment derived in Moon Creek is transported into the South Fork approximately 3 miles upstream of Kellogg, Idaho. Sediment transport gaging data are not available for Moon Creek; therefore, estimates of sediment yield are not provided in this report. Based on review of aerial photographs, sediment sources in Moon Creek are mining wastes, mobilization of channel bed sediment, bank erosion, and some rock debris situated adjacent to channels.

Segment MoonCrkSeg01, containing the West Fork of Moon Creek, has a drainage area of approximately 3.6 square miles. Based on the aerial photographs reviewed no major sources of sediment are contained in segment MoonCrkSeg01. The channel is contained in a narrow valley by well vegetated hillslopes. Likely sediment sources in MoonCrkSeg01 are channel bed remobilization and minor bank erosion. Sediment samples were not collected from this segment; however, one surface soil sample was collected from the Washington-Idaho Mine that is located adjacent to the West Fork. If we assume sediment concentrations may be represented by metals concentrations reported for soil, soil and sediment concentrations exceed screening levels for arsenic, cadmium, copper, lead, and zinc.

Segment MoonCrkSeg02, containing the headwaters and main stem of Moon Creek, has a drainage area of approximately 5.4 square miles. From the mouth to the confluence with the West Fork, the channel is situated in a valley floor 100 to 200 feet wide. Much of the width of the valley is occupied by residential dwellings. The channel appears to be confined to the current location by road embankments and culverts. The channel banks are moderately well vegetated for much of this reach. Many high gradient ephemeral channels enter in this section of channel.

Upstream of the West Fork Confluence, the channel is confined in general location by steep valley walls and road embankments. Approximately 4,000 feet upstream of the West Fork confluence and continuing 2,000 to 3,000 feet upstream, Moon Creek flows adjacent to rock piles and tailings ponds of both the Charles Dickens Mine and Silver Crescent Mill site. Likely sediment sources in segment MoonCrkSeg02 are channel bed remobilization and minor bank erosion. The rock debris piles in and around both the Charles Dickens Mine and Silver Crescent Mill site also may contribute to the sediment load.

Sediment samples were not collected from this segment; however, three surface soil samples were collected from mining-related sites located adjacent to Moon Creek. If we assume sediment concentrations may be represented by metals concentrations reported for soil, soil and sediment concentrations exceed screening levels for arsenic, cadmium, copper, lead, and zinc.

Sediment sources include channel bed remobilization, minor bank erosion, lateral migration and rock debris piles adjacent to the stream. Though suspended and bedload sediment samples were not collected and analyzed for metals, suspended and bedload sediment concentrations may be represented by metals concentrations reported for soil and sediment samples collected in the Moon Creek Watershed. As presented in Section 4.1, Nature and Extent, metals concentrations in soil samples exceeded screening levels, especially for arsenic, cadmium, copper, lead, and zinc.

5.4 SUMMARY OF FATE AND TRANSPORT

The probabilistic model was used to quantify and summarize the available data and to estimate pre-remediation metals concentrations in surface water and mass loading to Moon Creek. Results are summarized in this section.

Surface water discharge, metals concentrations (total and dissolved), and mass loading data were analyzed using lognormal PDFs at one sampling location in Moon Creek. Only results for cadmium, lead, and zinc were analyzed. Regressions were developed for total and dissolved concentrations versus discharge to quantify and identify trends in concentrations and mass loading with changing discharge rates.

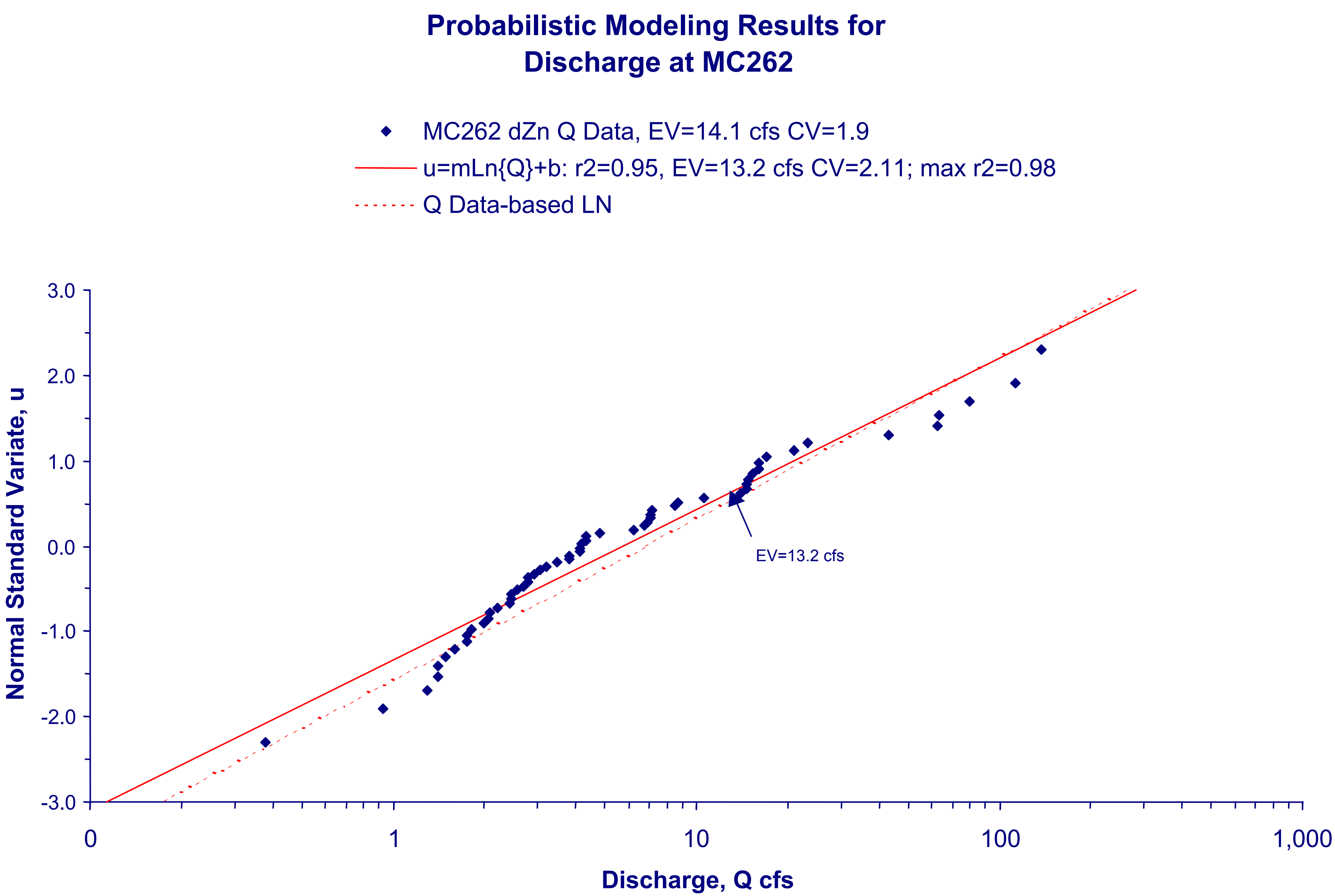
Results of the probabilistic modeling indicate:

- Estimated expected values of dissolved cadmium and zinc concentrations exceeded the screening levels. The estimated expected concentration of total lead was less than the screening level.

- Mass loading of cadmium and lead from Moon Creek into the South Fork were estimated to be minimal.

- Mass loading of dissolved zinc from Moon Creek into the South Fork was estimated to be 9.9 pounds/day.

- Potential sources of metals to Moon Creek include the Washington-Idaho Mine, Silver Crescent mine and mill complex and the Charles Dickens mine complex.



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RI REPORT

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Moon Creek Series
07/11/01

Figure 5.2-1

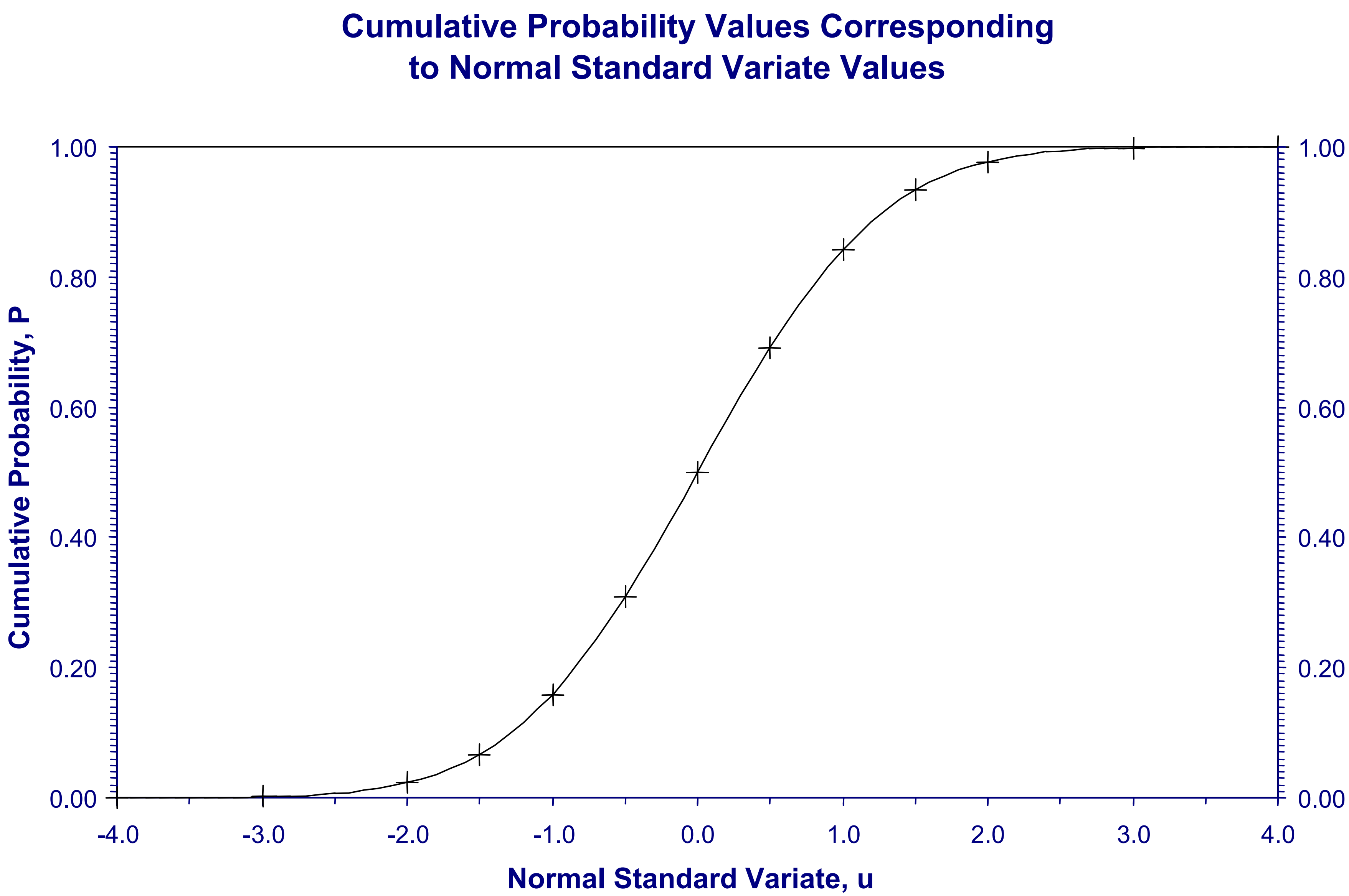

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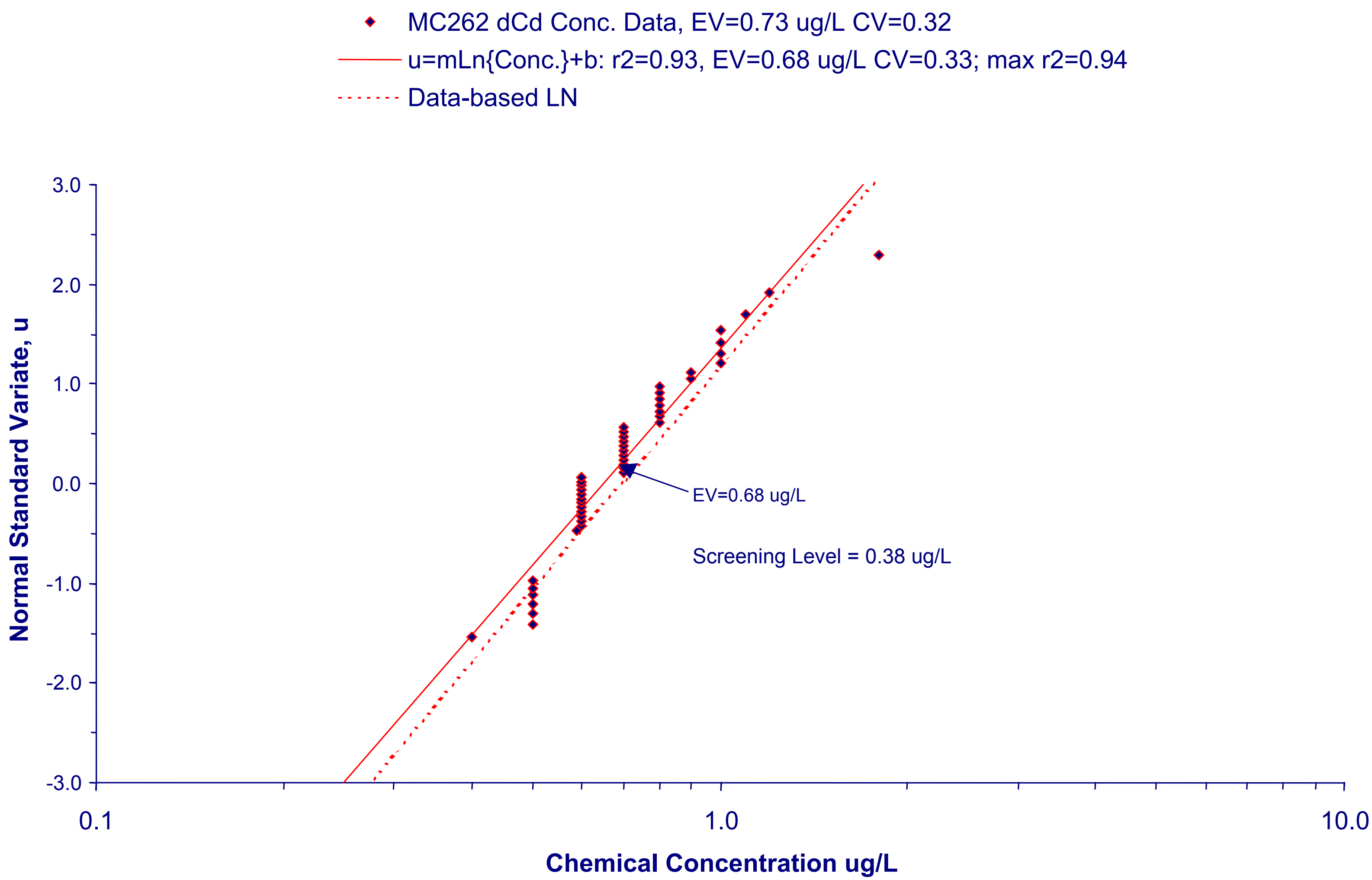
Figure 5.2-2

Probabilistic Modeling Results for Dissolved Cadmium Concentrations at MC262



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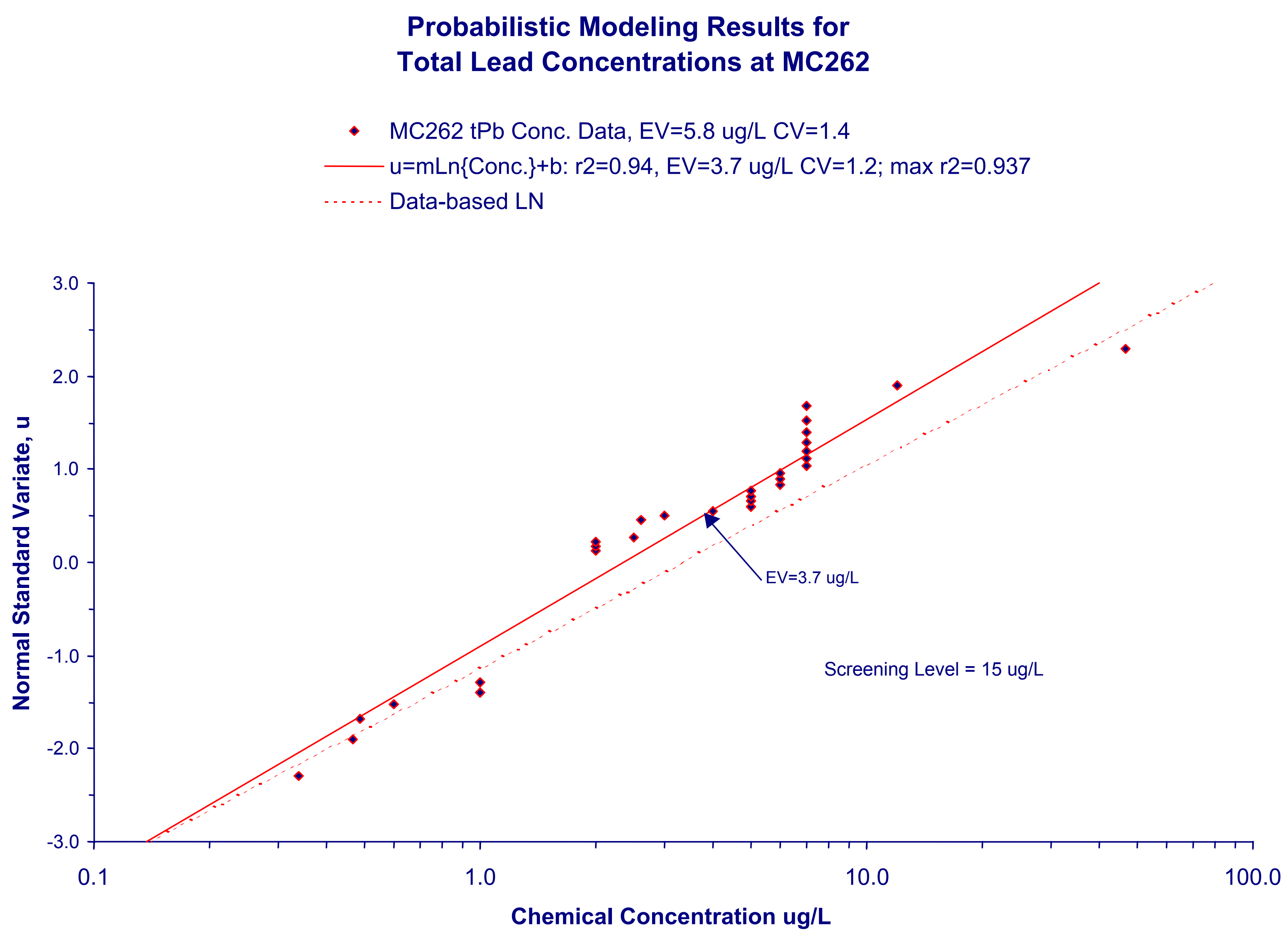

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Moon Creek Series
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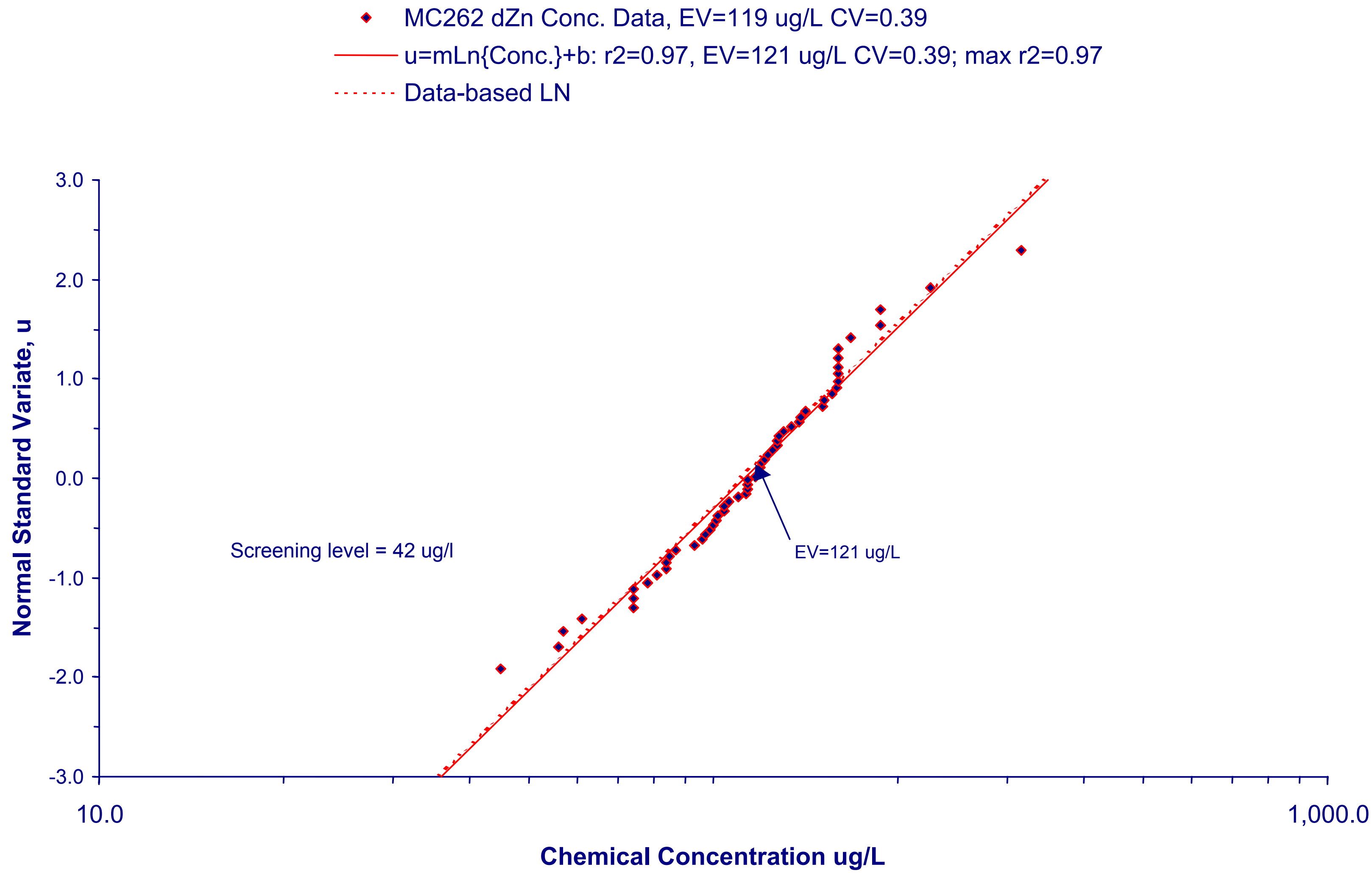
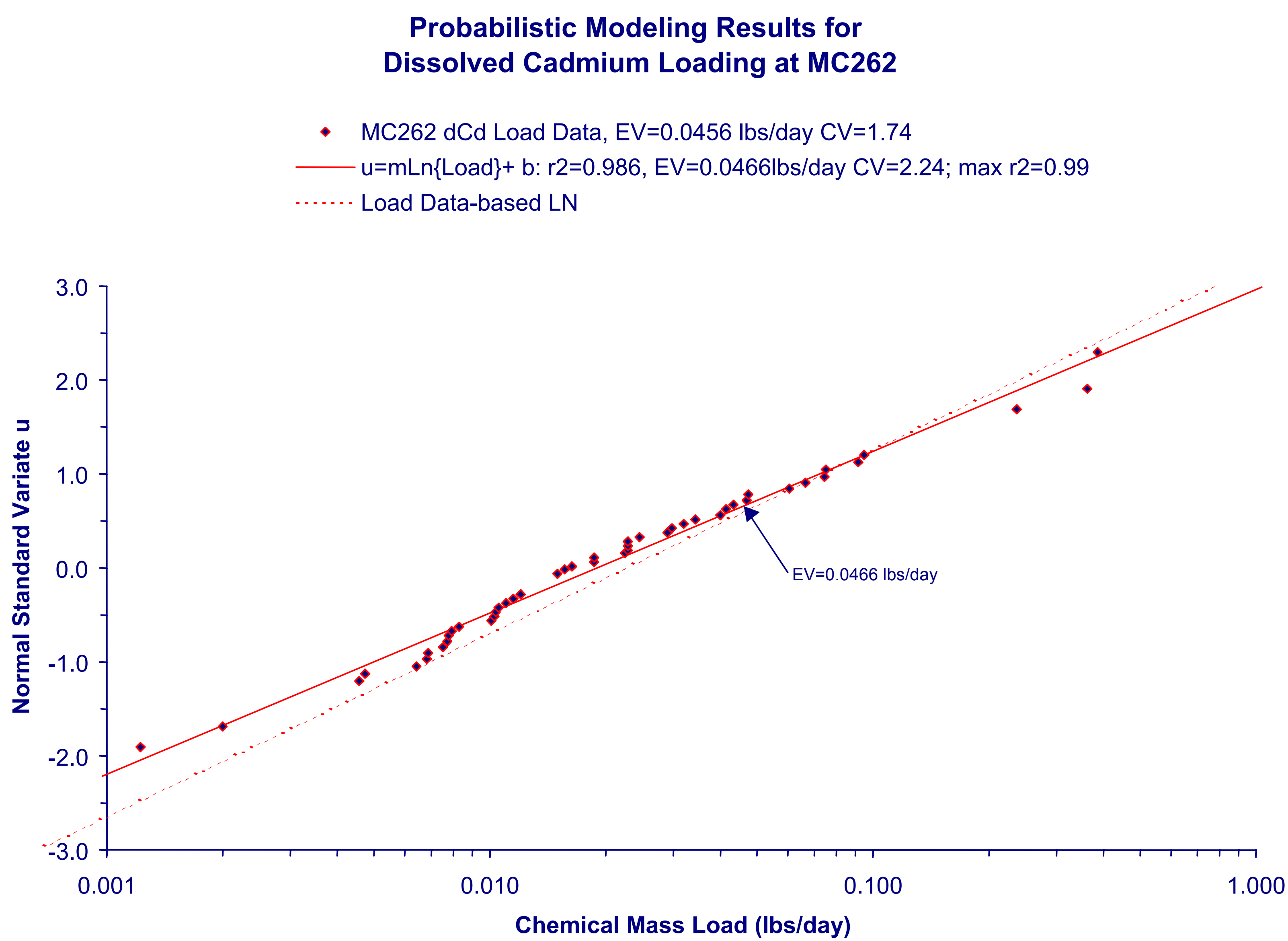
Figure 5.2-4

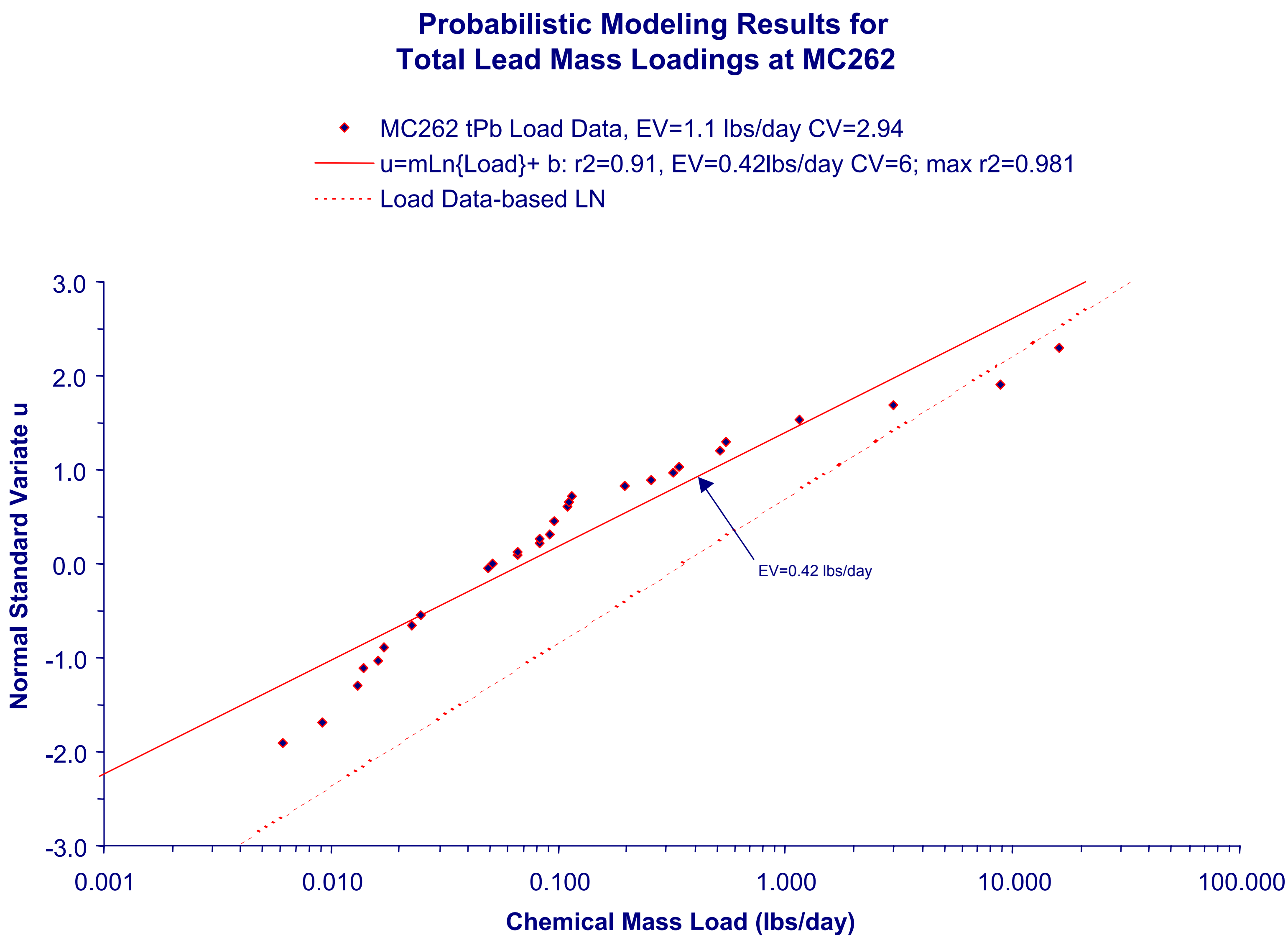
Probabilistic Modeling Results for Dissolved Zinc Concentrations at MC262



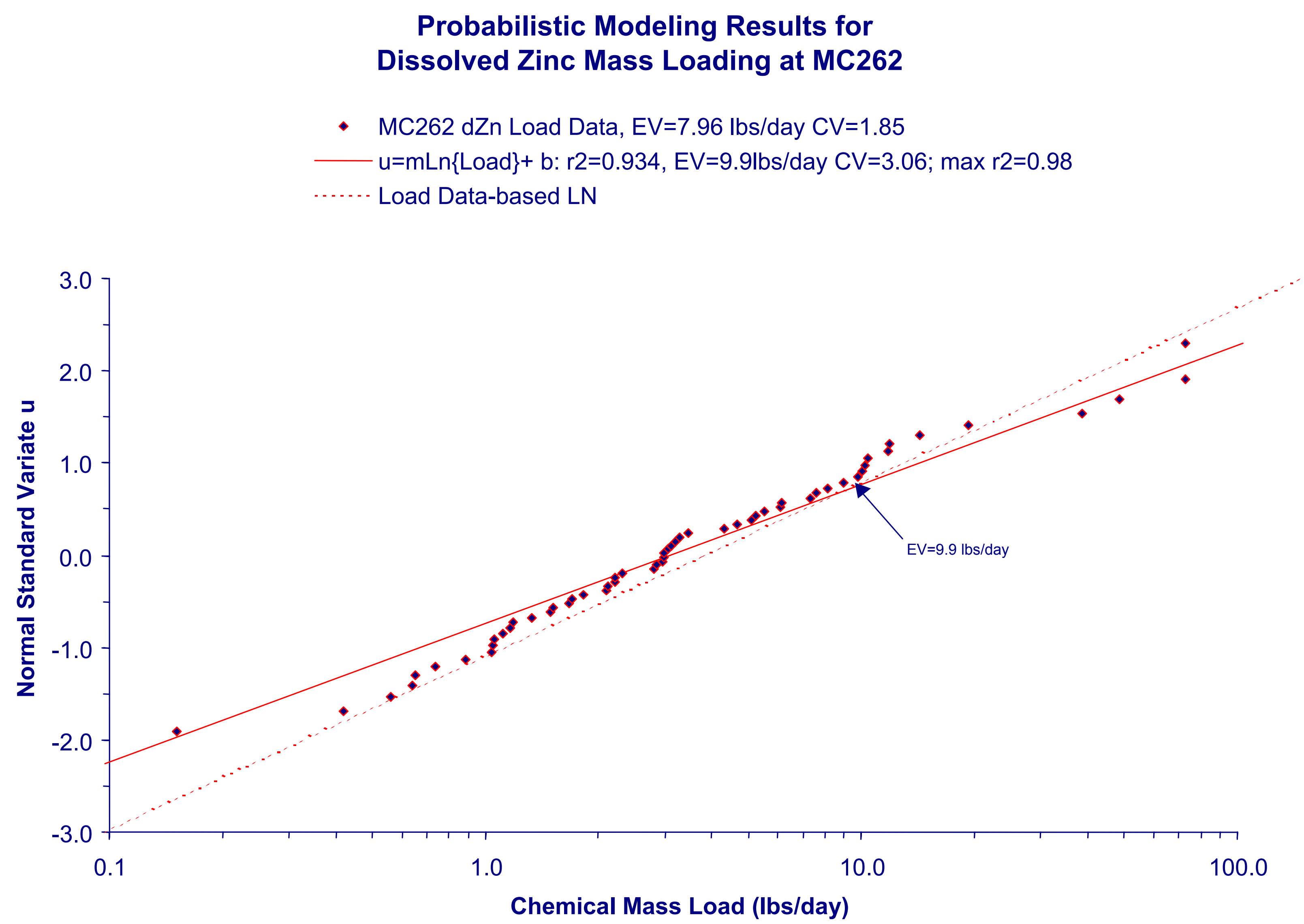
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Moon Creek Series 07/11/01	**Figure 5.2-5**



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Moon Creek Series 07/11/01	Figure 5.2-6



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Moon Creek Series 07/11/01	**Figure 5.2-7**



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Moon Creek Series 07/11/01	**Figure 5.2-8**

Table 5.1-1
Low and High Instantaneous Metal Loading Values for Six Sampling Events From May 1991 to May 1999

Metal	Low (pounds/day)	High (pounds/day)
Dissolved Cadmium	0.0002	0.388
Total Lead	0.006	3.02
Dissolved Lead	0.003	2.58
Dissolved Zinc	0.421	178.5

Table 5.2-1
Summary of Estimated Expected Values for Discharge, Metals Concentrations, and Mass Loading[a]

Sampling Location	Concentration (µg/L)			Mass Loading (pounds/day)			Discharge (cfs)
	Dissolved Cadmium	Total Lead	Dissolved Zinc	Dissolved Cadmium	Total Lead	Dissolved Zinc	
Screening Level	0.38	15	42	NA	NA	NA	NA
MC262	**0.68** (0.33)	3.7 (1.2)	**121** (0.39)	0.0466 (2.24)	0.42 (6)	9.9 (3.06)	13.2 (2.11)

[a]Summary tables with all modeling results are included in Appendix C.

Note:
cfs - cubic feet per second
µg/L - micrograms per liter
NA - not available
Values in parentheses are coefficients of variation.
Bold indicates exceedance of screening level

6.0 REFERENCES

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ATTACHMENT 1
Data Source References

Data Source References

Data Source References[a]	Data Source Name	Data Source Description	Reference
2	URS FSPA Nos. 1, 2, and 3	Fall 1997: Low Flow and Sediment Sampling	URS Greiner Inc. 1997. Field Sampling Plan Addendum 1 Sediment Coring in the Lower Coeur d'Alene River Basin, Including Lateral Lakes and River Floodplains
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 2 Adit Drainage, Seep and Creek Surface Water Sampling
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 3 Sediment Sampling Survey in the South Fork of the Coeur d'Alene River, Canyon Creek, and Nine-Mile Creek
3	URS FSPA No. 4	Spring 1998: High Flow Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 4 Adit Drainage, Seep and Creek Surface Water Sampling; Spring 1998 High Flow Event
4	MFG Historical Data Spring 1991	Spring 1991: High Flow Sampling	McCulley, Frick & Gillman, Inc. 1991. Upstream Surface Water Sampling Program Spring 1991 High Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
5	MFG Historical Data Fall 1991	Fall 1991: Low Flow Sampling	McCulley, Frick & Gillman, Inc. 1992. Upstream Surface Water Sampling Program Fall 1991 Low Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
6	EPA/Box Historical Data	Superfund Site Groundwater and Surface Water Data	CH2MHill. 1997. Location of Wells and Surface Water Sites, Bunker Hill Superfund Site. Fax Transmission of Map August 11, 1998
			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: BOXDATA.WK4
7	IDEQ Historical Data	IDEQ Water Quality Data	Idaho Department of Environmental Quality. 1998. Assortment of files from Glen Pettit for water years 1993 through 1996
			Idaho Department of Environmental Quality. 1998. E-mail from Glen Pettit October 6, 1998 Subject: DEQ Water Quality Data Files Attached: 1998 trend Samples.xls, 1997 trend Samples.xls

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Data Source References[a]	Data Source Name	Data Source Description	Reference
8	EPA/NPDES Historical Data	Water Quality based on NPDES Program	Environmental Protection Agency. 1998. E-mail from Ben Cope August 11, 1998/September 2, 1998. Subject: Better PCS Data Files/Smelterville. Attached: PCS2.WK4, PCSREQ.698/TMT-PLAN.XLS
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			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: PCSDATA.WK4
10	URS FSPA No. 5	Common Use Areas Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 5 Common Use Areas: Upland Common Use Areas and Lower Basin Recreational Beaches; Sediment/Soil, Surface Water, and Drinking Water Supply Characterization
11	URS FSPA No. 8	Source Area Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 8 Tier 2 Source Area Characterization Field Sampling Plan
12	Historical Groundwater Data from MFG	1997 Annual Groundwater Data Report Woodland Park	McCulley, Frick & Gillman. 1998. 1997 Annual Groundwater Data Report Woodland Park
13	Historical Data from US Forest Service, Idaho Geological Survey and others	Historical Data on Inactive Mine Sites USFS, IGS and CCJM, 1994-1997, Prichard Creek, Pine Creek and Summit Mining District	Mackey K, Yarbrough, S.L. 1995. Draft Removal Preliminary Assessment Report Pine Creek Millsites, Coeur d'Alene District, Idaho, Contract No. 1422-N651-C4-3049
			Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. I, Prichard Creek and Eagle Creek Drainages
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Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
13	Historical Data from US Forest Service, Idaho Geological Survey and others (continued)		Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. V, Coeur d'Alene River Drainage Surrounding the Coeur d'Alene Mining District (Excluding the Prichard Creek and Eagle Creek Drainages) Part 2 Secondary Properties
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			Trace Element Geochemistry of Bottom Sediments and Waters from the Lateral Lakes of Coeur d'Alene River, A Dissertation by F. Rabbi, May 1994
15	URS FSPA No. 9	Source Area Characterization; Field XRF Data	CH2M Hill and URS Greiner. 1998. Field Sampling Plan Addendum 9 Delineation of Contaminant Source Areas in the Coeur d'Alene Basin using Survey and Hyperspectral Imaging Techniques
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Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
18	USGS Snomelt Surface Water Data	Surface Water Data from 1999 Snomelt Runoff Hydrograph	USGS. 1999. USGS WY99.xls Spreadsheet dowloaded from USGS (Coeur d'Alene Office) ftp site
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured near the Peak of the 1999 Snomelt Runoff Hydrograph at 42 Stations, Coeur d'Alene River Basin Idaho
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured on the Ascending and Descending Limbs of the 1999 Snomelt Runoff Hydrograph at Nine Stations, Coeur d'Alene River Basin Idaho
22	MFG Report on Union Pacific Railroad Right-of-Way Soil Sampling	Surface and Subsurface Soil Lead Data	MFG. 1997. Union Pacific Railroad Wallace Branch, Rails to Trails Conversion, Right-of-Way Soil Sampling, Summary and Interpretation of Data. McCulley, Frick and Gilman, Inc. March 14, 1997
23	URS FSPA No. 11A	Source Area Groundwater and Surface Water Sampling	URS Greiner Inc. 1999. Field Sampling Plan Addendum 11A Tier 2 Source Area Characterization
24	URS FSPA No. 15	Common Use Area Sampling—Spokane River	URS Greiner Inc. 1999. Field Sampling Plan Addendum 15 Spokane River - Washington State Common Use Area Sediment Characterization
25	URS FSPA No. 18	Depositional and Common Use Area Sediment Sampling - Spokane River	URS Greiner Inc. 2001. Final Field Sampling Plan Addendum No. 18, Fall 2000 Field Screening of Sediment in Spokane River Depositional Areas, Summary of Results. Revision 1. January 2001.
28	USGS National Water Quality Assessment data base	Surface water data for sampling location NF50 at Enaville, Idaho	USGS. 2001. USGS National Water Quality Assessment database: http://infotrek.er.usgs.gov/pls/nawqa/nawqa.wwv_main.gohome. Data retrieved on August 2, 2001 for station 12413000, NF Coeur'dAlene River At Enaville, Idaho.

[a]Reference Number is the sequential number used as cross reference to associate chemical results in data summary tables with specific data collection efforts.

ATTACHMENT 2
Data Summary Tables

ABBREVIATIONS USED IN DATA SUMMARY TABLE

LOCATION TYPES:

AD adit
BH borehole
FP flood plain
GS ground surface/near surface
HA hand auger boring
LK lake/pond/open reservoir
OF outfall/discharge
RV river/stream
SP stockpile
TL tailings pile

QUALIFIERS:

U Analyte was not detected above the reported detection limit
J Estimated concentration

DATA SOURCE REFERENCES:

Data source references listed in Attachment 1 are included in these tables in the "Ref" column.

Data Summary Table
Moon Creek - segment MoonCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X	Shaded Sample Results Exceed Screening Level By More Than 10X	Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
MC8266	TL	13	---			**410**	**13**	87	44000	**1200**	830			**1100**

Data Summary Table
Moon Creek - segment MoonCrkSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
MC8161	TL	13	---			**1300**	**110**	**1400**	**110000**	**11000**	73			**16000**
MC8162	TL	13	---			**960**	3	**390**	41000	**8600**	140			**1000**
MC8265	TL	13	---			**1700**	4.9	**260**	**82000**	**480**	110			230
Surface Water - Total Metals (ug/l)														
MC262	RV	2	11/05/1997		0.28 U	0.42	0.56	**1.2**	5 U	0.47 J	1.8 J	0.1 U	0.22 U	**135**
MC262	RV	4	05/14/1991				0.5			4				**113**
MC262	RV	5	10/01/1991				0.5			5				**158**
MC262	RV	7	10/29/1993				0.6			2.5 U				**152**
MC262	RV	7	12/01/1993				0.7			2.5 U				**157**
MC262	RV	7	12/21/1993				0.7			7				**178**
MC262	RV	7	01/21/1994				0.5 J			2.5 U				**155**
MC262	RV	7	02/17/1994				0.8			2.5 U				**156**
MC262	RV	7	03/07/1994				0.5 J			2.5 U				**116**
MC262	RV	7	03/23/1994				0.5 J			2.5 U				**117**
MC262	RV	7	04/06/1994				0.6			2.5 U				**106**
MC262	RV	7	04/18/1994				0.6			2.5 U				**97**
MC262	RV	7	05/03/1994				0.6			2.5 U				**101**
MC262	RV	7	05/20/1994				0.8			2.5 U				**125**
MC262	RV	7	06/07/1994				0.7			2.5 U				**137**
MC262	RV	7	06/24/1994				0.7			2.5 U				**125**
MC262	RV	7	07/22/1994				0.8			2.5 U				**103**
MC262	RV	7	08/17/1994				0.8			2.5 U				**74**
MC262	RV	7	09/26/1994				0.25 U			2.5 U				**96**
MC262	RV	7	10/05/1994				0.5 J			2.5 U				**88**
MC262	RV	7	11/16/1994				0.5 J			2.5 U				**151**
MC262	RV	7	12/14/1994				0.7			2.5 U				**162**
MC262	RV	7	01/10/1995				0.5 J			2.5 U				**160**
MC262	RV	7	02/09/1995				0.6			2.5 U				**113**
MC262	RV	7	03/08/1995				0.6			2.5 U				**127**
MC262	RV	7	03/22/1995				0.9			7				**120**
MC262	RV	7	04/12/1995				0.8			6				**128**
MC262	RV	7	04/25/1995				1.2			7				**117**
MC262	RV	7	05/09/1995				1			7				**153**
MC262	RV	7	05/23/1995				1.1			2.5 U				**127**
MC262	RV	7	06/12/1995				0.8			5 J				**137**

Data Summary Table
Moon Creek - segment MoonCrkSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X	Shaded Sample Results Exceed Screening Level By More Than 10X	Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
MC262	RV	7	06/27/1995				0.6			7				**105**
MC262	RV	7	07/11/1995				0.8			2.5 U				**130**
MC262	RV	7	07/25/1995				0.7			6				**109**
MC262	RV	7	08/14/1995				0.6			5 J				**118**
MC262	RV	7	09/13/1995				0.6			7				**113**
MC262	RV	7	10/18/1995				1			5 J				**183**
MC262	RV	7	11/21/1995				0.7			6				**164**
MC262	RV	7	12/27/1995				1			2.5 U				**157**
MC262	RV	7	01/17/1996				0.7			12				**124**
MC262	RV	7	02/28/1996				0.5 J			6				**111**
MC262	RV	7	03/27/1996				0.25 U			2.5 U				**122**
MC262	RV	7	04/17/1996				0.5 J			10				**169**
MC262	RV	7	05/08/1996				0.5 J			8				**129**
MC262	RV	7	06/19/1996				0.6			5 J				**111**
MC262	RV	7	07/24/1996				0.6			6				**99**
MC262	RV	7	08/21/1996				0.7			15				**96**
MC262	RV	7	09/26/1996				0.6			2.5 U				**103**
MC262	RV	7	10/29/1996				0.7			5				**122**
MC262	RV	7	11/26/1996				0.6			7				**145**
MC262	RV	7	12/13/1996				0.6			2.5				**144**
MC262	RV	7	01/29/1997				0.6			2.5				**163**
MC262	RV	7	02/21/1997				0.5			6				**122**
MC262	RV	7	03/26/1997				0.9			0.06				**178**
MC262	RV	7	04/16/1997							**26**				**145**
MC262	RV	7	04/16/1997				0.7							
MC262	RV	7	06/23/1997				0.5			8				**95**
MC262	RV	7	07/23/1997				0.8			7				**143**
MC262	RV	7	08/14/1997				0.6			2.5				**119**
MC262	RV	7	09/03/1997				0.25			2.5				**82**
MC262	RV	7	10/16/1997				0.7			2.5				**132**
MC262	RV	7	11/24/1997				0.7			2.5				**135**
MC262	RV	7	12/17/1997				0.7			2.5				**168**
MC262	RV	7	01/21/1998				0.7			4				**158**
MC262	RV	7	02/25/1998				0.25			2.5				**109**
MC262	RV	7	03/20/1998				0.5			2.5				**119**
MC262	RV	7	04/23/1998				0.6			2.5				**132**
MC262	RV	18	10/28/1998				1			2				**120**

Data Summary Table
Moon Creek - segment MoonCrkSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
MC262	RV	18	11/18/1998				1 UJ			2				**120**
MC262	RV	18	12/14/1998				1 UJ			2				**160**
MC262	RV	18	01/21/1999				1 UJ			3				**100**
MC262	RV	18	03/22/1999				1 UJ			**47**				**110**
MC262	RV	18	04/20/1999				1 UJ			5				**40**
MC262	RV	18	05/04/1999							1				**60**
MC262	RV	18	05/23/1999						30		2			**70**
MC262	RV	18	06/16/1999							1				**70**
MC262	RV	18	07/20/1999							0.49				**90.5**
MC262	RV	18	08/04/1999							0.34				**78**
MC262	RV	18	08/31/1999							0.6				**82.9**
MC262	RV	7	05/28/1998				0.5 U			12				**105**
MC262	RV	7	06/25/1998				0.6			5 U				**134**
MC262	RV	7	07/27/1998				0.6			5 U				**90**
MC262	RV	7	08/25/1998				0.5			6				**98**
MC262	RV	7	09/24/1998				0.5 U			5 U				**109**
MC262	RV	7	10/26/1998				0.5			5 U				**98**
MC262	RV	7	11/24/1998				0.9			5 U				**131**
MC262	RV	7	12/31/1998				0.7			7				**96**
MC262	RV	7	01/15/1999				**2.4**			14				**104**
MC262	RV	7	02/22/1999				0.9			5 U				**126**
MC262	RV	7	03/08/1999				0.6			5 U				**119**
MC262	RV	3	05/05/1998		0.3	2 U	1.9	2 U	38	2.6	10	0.2 U	0.2 U	**316**
MC8122	SP	13	---			29 U	**7**	35 U	12 U	15 U	4	5 U		3 U
MC8123	AD	13	---			23	**6**	35 U	300	15 U	**150**	5 U		30
MC8124	RV	13	---			29 U	**5**	35 U	12	3.1	12	5 U		**330**
Surface Water - Dissolved Metals (ug/l)														
MC262	RV	2	11/05/1997		0.5 U	0.42	**0.59**	0.84	10 U	0.23	1	0.2 U	0.03 U	**130**
MC262	RV	4	05/14/1991				**0.5**			3 U				**102**
MC262	RV	5	10/01/1991				**0.4**			1 U				**84**
MC262	RV	7	10/29/1993				**0.6**			1.5 U				**160**
MC262	RV	7	12/01/1993				**0.7**			1.5 U				**160**
MC262	RV	7	12/21/1993				**0.7**			1.5 U				**187**
MC262	RV	7	01/21/1994				**0.6**			1.5 U				**160**
MC262	RV	7	02/17/1994				**0.8**			1.5 U				**156**
MC262	RV	7	03/07/1994				**0.6**			1.5 U				**114**

Data Summary Table
Moon Creek - segment MoonCrkSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
MC262	RV	7	03/23/1994				0.5 J			1.5 U				119
MC262	RV	7	04/06/1994				1			1.5 U				101
MC262	RV	7	04/18/1994				0.6			1.5 U				97
MC262	RV	7	05/03/1994				0.9			1.5 U				104
MC262	RV	7	05/20/1994				0.8			1.5 U				127
MC262	RV	7	06/07/1994				0.8			1.5 U				141
MC262	RV	7	06/24/1994				0.8			1.5 U				121
MC262	RV	7	07/22/1994				0.6			1.5 U				104
MC262	RV	7	08/17/1994				0.6			2.5 J				74
MC262	RV	7	09/26/1994				0.6			1.5 U				87
MC262	RV	7	10/05/1994				0.5 J			1.5 U				78
MC262	RV	7	11/16/1994				0.5 J			1.5 U				152
MC262	RV	7	12/14/1994				0.8			1.5 U				159
MC262	RV	7	01/10/1995				0.7			1.5 U				160
MC262	RV	7	02/09/1995				0.7			1.5 U				114
MC262	RV	7	03/08/1995				0.6			1.5 U				120
MC262	RV	7	03/22/1995				0.9			6				113
MC262	RV	7	04/12/1995				0.7			1.5 U				117
MC262	RV	7	04/25/1995				1.2			3 J				114
MC262	RV	7	05/09/1995				0.8			4				128
MC262	RV	7	05/23/1995				1.1			3 J				125
MC262	RV	7	06/12/1995				0.7			4				134
MC262	RV	7	06/27/1995				0.7			1.5 U				96
MC262	RV	7	07/11/1995				0.7			1.5 U				139
MC262	RV	7	07/25/1995				0.7			3 J				106
MC262	RV	7	08/14/1995				0.7			80				226
MC262	RV	7	09/13/1995				0.8			4				110
MC262	RV	7	10/18/1995				0.9			2.5 J				174
MC262	RV	7	11/21/1995				0.6			3 J				164
MC262	RV	7	12/27/1995				0.8			1.5 U				149
MC262	RV	7	01/17/1996				0.7			4				109
MC262	RV	7	02/28/1996				0.5 J			3 J				125
MC262	RV	7	03/27/1996				0.5 J			1.5 U				198
MC262	RV	7	04/17/1996				0.5 J			3 J				154
MC262	RV	7	05/08/1996				0.6			4				125
MC262	RV	7	06/19/1996				0.6			3 J				144
MC262	RV	7	07/24/1996				0.6			1.5 U				93

Data Summary Table
Moon Creek - segment MoonCrkSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
MC262	RV	7	08/21/1996				**0.6**			**4**				**86**
MC262	RV	7	09/26/1996				**0.7**			1.5 U				**110**
MC262	RV	7	10/29/1996				**0.7**			0.15				**115**
MC262	RV	7	11/26/1996				**0.6**			0.15				**146**
MC262	RV	7	12/13/1996				**0.6**			**1.5**				**152**
MC262	RV	7	01/29/1997				**0.6**			**1.5**				**129**
MC262	RV	7	02/21/1997				**0.5**			**1.5**				**120**
MC262	RV	7	03/26/1997				**0.6**			**6**				**106**
MC262	RV	7	04/16/1997				**0.6**			**4**				**105**
MC262	RV	7	06/23/1997				**0.5**			**2.5**				**166**
MC262	RV	7	07/23/1997				**0.8**			**3**				**156**
MC262	RV	7	08/14/1997				**0.6**			**3**				**111**
MC262	RV	7	09/03/1997				**0.5**			**3**				**92**
MC262	RV	7	10/16/1997				**0.7**			**1.5**				**120**
MC262	RV	7	11/24/1997				**0.7**			**1.5**				**132**
MC262	RV	7	12/17/1997				**0.7**			**1.5**				**154**
MC262	RV	7	01/21/1998				**0.5**			**1.5**				**142**
MC262	RV	7	02/25/1998				**0.5**			**1.5**				**110**
MC262	RV	7	03/20/1998				**0.5**			**1.5**				**111**
MC262	RV	7	04/23/1998				**0.6**			**1.5**				**151**
MC262	RV	18	10/28/1998				1 UJ			**1.4**				**127**
MC262	RV	18	11/18/1998				1 UJ			1				**123**
MC262	RV	18	12/14/1998				1 UJ			1				**167**
MC262	RV	18	01/21/1999				0.001 UJ			0.001				0.101
MC262	RV	18	03/22/1999				1 UJ			1				**57**
MC262	RV	18	04/20/1999				1 UJ			1				**45**
MC262	RV	18	05/04/1999				**1**			1				**56**
MC262	RV	18	05/23/1999				**1**		10	1	1.6			**61**
MC262	RV	18	06/16/1999				**1**			1				**74**
MC262	RV	18	07/20/1999				1 U			1 U				**93**
MC262	RV	18	08/04/1999				1 U			1 U				**81**
MC262	RV	18	08/31/1999				1 U			1 U				**85**
MC262	RV	7	05/28/1998				0.5 U			3 U				**99**
MC262	RV	7	06/25/1998				**0.6**			3 U				**138**
MC262	RV	7	07/27/1998				**0.6**			3 U				**87**
MC262	RV	7	08/25/1998				**0.5**			3 U				**84**
MC262	RV	7	09/24/1998				0.5 U			3 U				**100**

Data Summary Table
Moon Creek - segment MoonCrkSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X	Shaded Sample Results Exceed Screening Level By More Than 10X	Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
MC262	RV	7	10/26/1998				**0.5**			3 U				**87**
MC262	RV	7	11/24/1998				**0.9**			3 U				**130**
MC262	RV	7	12/31/1998				**0.8**			3 U				**99**
MC262	RV	7	01/15/1999				**1**			3 U				**94**
MC262	RV	7	02/22/1999				**0.9**			3 U				**125**
MC262	RV	7	03/08/1999				**0.7**			3 U				**113**
MC262	RV	3	05/05/1998		0.3	2 U	**1.8**	2	20 U	1	11	0.2 U	0.2 U	**318**
MC8122	SP	13	---				2.3 U	8.4 U	3.7 U		1.2 U			2.8
MC8123	AD	13	---				2.3 U		250		**130**			21
MC8123	AD	13	---					8 U						
MC8124	RV	13	---				**3.7**		3.7 U		8.1			**340**
MC8124	RV	13	---					8 U						

ATTACHMENT 3
Statistical Summary Tables for Metals

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment MoonCrkSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Arsenic	1	1	410	410	410	< 0.001	22	1	1	0
Cadmium	1	1	13	13	13	< 0.001	9.8	1	0	0
Copper	1	1	87	87	87	< 0.001	100	0	0	0
Iron	1	1	44,000	44,000	44,000	< 0.001	65,000	0	0	0
Lead	1	1	1,200	1,200	1,200	< 0.001	171	1	0	0
Manganese	1	1	830	830	830	< 0.001	3,597	0	0	0
Zinc	1	1	1,100	1,100	1,100	< 0.001	280	1	0	0

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment MoonCrkSeg02
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Arsenic	3	3	960	1,700	1,320	0.28	22	3	3	0
Cadmium	3	3	3	110	39.3	1.56	9.8	1	1	0
Copper	3	3	260	1,400	683	0.91	100	3	1	0
Iron	3	3	41,000	110,000	77,700	0.45	65,000	2	0	0
Lead	3	3	480	11,000	6,690	0.82	171	3	2	0
Manganese	3	3	73	140	108	0.31	3,597	0	0	0
Zinc	3	3	230	16,000	5,740	1.55	280	2	1	0

Statistical Summary of Total Metals Concentrations in Surface Water
Segment MoonCrkSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	2	1	0.3	0.3	0.3	< 0.001	6	0	0	0
Arsenic	5	2	0.42	23	11.7	1.37	50	0	0	0
Cadmium	87	78	0.25	7	0.908	1.19	2	4	0	0
Copper	5	1	1.2	1.2	1.2	< 0.001	1	1	0	0
Iron	6	4	12	300	95	1.44	300	0	0	0
Lead	92	57	0.06	47	6.03	1.16	15	2	0	0
Manganese	6	6	1.8	150	30	1.97	50	1	0	0
Zinc	93	92	30	330	125	0.34	30	91	2	0

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment MoonCrkSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	2	1	0.3	0.3	0.3	< 0.001	2.92	0	0	0
Arsenic	2	1	0.42	0.42	0.42	< 0.001	150	0	0	0
Cadmium	93	80	0.4	3.7	0.736	0.53	0.38	80	0	0
Copper	5	2	0.84	2	1.42	0.58	3.2	0	0	0
Iron	6	2	10	250	130	1.31	1,000	0	0	0
Lead	90	46	0.001	80	3.97	2.9	1.09	34	1	0
Manganese	6	5	1	130	30.3	1.84	20.4	1	0	0
Zinc	93	93	0.101	340	121	0.4	42	90	0	0

ATTACHMENT 4
Screening Levels

SCREENING LEVELS

Based on the results of the human health and ecological risk assessments, 10 chemicals of potential concern (COPCs) were identified for inclusion and evaluation in the RI. The COPCs and appropriate corresponding media (soil, sediment, groundwater, and surface water) are summarized in Table 1. For each of the COPCs listed in Table 1, a screening level was selected.

The screening levels were used in the RI to help identify source areas and media of concern that would be carried forward for evaluation in the feasibility study (FS). The following paragraphs discuss the rationale for the selection of the screening levels.

Applicable risk-based screening levels and background concentrations were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional background studies for soil, sediment, and surface water, and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). Selected RI screening levels are listed in Tables 2 through 4.

For the evaluation of site soil, sediment, groundwater, and surface water chemical data, the lowest available risk-based screening level for each media was selected as the screening level. If the lowest risk-based screening level was lower than the available background concentration, the background concentration was selected as the screening level.

Groundwater data are screened against surface water screening levels to evaluate the potential for impacts to surface water from groundwater discharge.

For site groundwater and surface water, total and dissolved metals data are evaluated separately. Risk-based screening levels for protection of human health (consumption of water) are based on total metals results, therefore, total metals data for site groundwater and surface water were evaluated against screening levels selected from human health risk-based screening levels. Risk-based screening levels for protection of aquatic life are based on dissolved metals results, therefore, dissolved metals data for site groundwater and surface water were evaluated against screening levels selected from aquatic life risk-based screening levels.

Table 1
Chemicals of Potential Concern

Chemical	Human Health COPC			Ecological COPC		
	Soil/Sediment	Groundwater	Surface Water	Soil	Sediment	Surface Water
Antimony	X	X				
Arsenic	X	X	X	X	X	
Cadmium	X	X	X	X	X	X
Copper				X	X	X
Iron	X					
Lead	X	X	X	X	X	X
Manganese	X		X			
Mercury			X		X	
Silver					X	
Zinc	X	X	X	X	X	X

Table 2
Selected Screening Levels for Groundwater and Surface Water—Coeur d'Alene River Basin and Coeur d'Alene Lake

Chemical	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Groundwater Total (µg/L)	Groundwater Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c,d]	50[a]	150[c,d]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	3.2[c,d]	1[e]	3.2[c,d]
Iron	300[a]	1,000[c,d]	300[a]	1,000[c,d]
Lead	15[a]	1.09[b]	15[a]	1.09[b]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c,d]	2[a]	0.77[c,d]
Silver	100[a]	0.43[c,d]	100[a]	0.43[c,d]
Zinc	30[e]	42[c,d]	30[e]	42[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
Values above correspond to a hardness value of 30 mg/L.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of
Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 3
Selected Screening Levels for Surface Water—Spokane River Basin

Chemical	SpokaneRSeg01		SpokaneRSeg02		SpokaneRSeg03	
	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c]	50[a]	150[c]	50[a]	150[c]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	2.3[c,d]	1[e]	3.8[c,d]	1[e]	5.7[c,d]
Iron	300[a]	1,000[c]	300[a]	1,000[c]	300[a]	1,000[c]
Lead	15[a]	1.09[b]	15[a]	1.09[b]	15[a]	1.4[c,d]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c]	2[a]	0.77[c]	2[a]	0.77[c]
Silver	100[a]	0.22[c,d]	100[a]	0.62[c,d]	100[a]	1.4[c,d]
Zinc	30[e]	30[c,d]	30[e]	50[c,d]	30[e]	75[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database. Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of $CaCO_3$) in the water column.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 4
Selected Screening Levels—Soil and Sediment

Chemical	Upper Coeur d'Alene River Basin		Lower Coeur d'Alene River Basin		Spokane River Basin	
	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)
Antimony	31.3[a]	3.30[b]	31.3[a]	3[c]	31.3[a]	3[c]
Arsenic	22[b]	13.6[b]	12.6[b]	12.6[b]	9.34[b]	9.34[b]
Cadmium	9.8[d]	1.56[b]	9.8[d]	0.678[b]	9.8[d]	0.72[b]
Copper	100[d]	32.3[b]	100[d]	28[c]	100[d]	28[c]
Iron	65,000[b]	40,000[c]	27,600[b]	40,000[c]	25,000[b]	40,000[c]
Lead	171[b]	51.5[b]	47.3[b]	47.3[b]	14.9[b]	14.9[b]
Manganese	3,597[b]	1,210[b]	1,760[a]	630[c]	1,760[a]	663[b]
Mercury	23.5[a]	0.179[b]	23.5[a]	0.179[b]	23.5[a]	0.174[c]
Silver	391[a]	4.5[c]	391[a]	4.5[c]	391[a]	4.5[c]
Zinc	280[b]	200[b]	97.1[b]	97.1[b]	66.4[b]	66.4[b]

[a]U.S. EPA Region IX Preliminary Remediation Goals for Residential or Industrial Soil http://www.epa.gov/region09/wasate/sfund/prg. February 3, 2000.
[b]Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Values as presented in National Oceanographic and Atmospheric Administration Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA. M. F. Buchman, 1999. Values generated from numerous reference documents.
[d]Final Ecological Risk Assessment. Coeur d'Alene Basin RI/FS. Prepared by CH2M HILL/URS for EPA Region 10. May 18, 2001. Values are the lowest of the NOAEL-based PRGs for terrestrial biota (Table ES-3).

Note:
mg/kg - milligram per kilogram